Water Quality Control Plan Report

CENTRAL COASTAL BASIN (3)

STATE WATER RESOURCES CONTROL BOARD

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CENTRAL COAST REGION (3)

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STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 75-21

APPROVAL OF WATER QUALITY CONTROL PLANS FOR THE CENTRAL COASTAL BASIN (3), SANTA CLARA RIVER BASIN (4A), LOS ANGELES RIVER BASIN (4B), AND SAN DIEGO BASIN (9)

WHEREAS:

1. It is the responsibility of the State Board and the California Regional Water Quality Control Boards to regulate the activities and factors which affect or may affect the quality of the waters of the State in order to attain the highest water quality which is reasonable considering all demands being made and to be made on those waters and the beneficial uses involved.

2. Regulation 40 CFR 131.202, pursuant to the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), requires each state to submit water quality control plans for all basin planning areas within the state by July 1, 1975.

3. The respective California Regional Water Quality Control Boards have conducted public hearings after notice to all interested persons in accordance with PL 92-500 and the California Water Code, and have considered the evidence introduced at those hearings. Those Boards subsequently adopted the water quality control plans for the Central Coastal Basin (3), Santa Clara River Basin (4A), Los Angeles River Basin (4B), and San Diego Basin (9).

4. Section 13245 of the Water Code provides that the State Board must approve all water quality control plans and revisions thereof before they become effective.

5. The water quality control plans are a part of the State's continuing planning process and will be updated annually to reflect changing conditions.

6. Issues, particularly those noted in the water quality control plans and identified in public hearings, which are not fully resolved in the plans at this time will be considered during the scheduled revisions of the plans.

7. Part I of the water quality control plans includes all necessary elements of a water quality control plan in accordance with Sections 13241 and 13242 of the Water Code and federal requirements, and Part II consists of supportive planning information.

8. The approval of water quality control plans is categorically exempt from the requirements of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) in accordance with Section 21084 of the Public Resources Code, Section 15108 of the State EIR Guidelines (California Administrative Code, Title 14, Division 6, Chapter 3), and Section 2714(d), Subchapter 17, Chapter 3, Title 23, California Administrative Code.

THEREFORE BE IT RESOLVED:

1. That the State Board approves Part I of the water quality control plans for the Central Coastal Basin (3), Santa Clara River Basin (4A), Los Angeles River Basin (4B), and San Diego Basin (9) in accordance with Section 13245 of the Water Code with the understanding that the stipulated control actions set forth in Chapter V are to be implemented, but that identified actions set forth in Chapter V other than control actions are recommendations to be taken under consideration by the State Board, Regional Boards, and other appropriate agencies.

2. That approval of Part I of the plans does not mandate the construction of facilities or mandate activities outside of the State Board's jurisdiction.

3. That the State Board shall file a notice of exemption in accordance with Section 15074 of the State EIR Guidelines.

4. That the Executive Officer is directed to forward copies of the water quality control plans for the Central Coastal Basin (3), Santa Clara River Basin (4A), Los Angeles River Basin (4B), and San Diego Basin (9) to the Environmental Protection Agency in fulfillment of the requirements of PL 92-500.

CERTIFICATION

The State Water Resources Control Board has determined that there is no state mandate for a new program or increased level of service on any unit of local government as a result of the foregoing resolution because such resolution is not an executive regulation pursuant to Revenue and Taxation Code, Section 2209.

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on March 20, 1975.

Bill B. Dendy

Bill B. Dendy
Executive Officer

WATER QUALITY CONTROL PLAN
CENTRAL COASTAL BASIN

PART I

April 1975

STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

PART I. WATER QUALITY CONTROL PLAN

SECTION 1. BENEFICIAL USES

Chapter 1 Historical Beneficial Uses

FOREWORD

The State Water Resources Control Board and the nine California Regional Water Quality Boards early in 1972 commenced the second phase of a comprehensive planning effort that will result in the development of water quality control plans in the entire State. The first phase was completed in 1971 with the adoption of interim water quality control plans and by the Regional Boards and approval by the State Board. This work is in fulfillment of provisions of the Federal Water Pollution Control Act.

Water is a scarce and precious resource in California. While California is endowed with more water of good quality than many areas of the nation, the compound effects of increased use of water and increasing volume and strength of municipal, industrial and agricultural wastes have degraded and threatened water quality in many areas of the State. The two season rainfall pattern and wide variations in total rainfall affect water quality; areas of abundant annual rainfall are characteristically dry in summer. Water quality and water quantity problems are usually interrelated.

Correction of these problems, plus the overall demand for a clean evnironment, require a water quality control and water resource management policy that provides for adequate protection of water resources to ensure their preservation for the beneficial uses and enjoyment of present and future generations of Californians. Recognizing water as a scarce resource, a policy encouraging reclamation of wastewater resources is translated to specific plans in areas where reuse can be accomplished as part of the water quality control plan. This fully developed water quality control plan supersedes previous water quality plans and becomes part of the California Water Plan.

The basic purpose of the Board's basin planning effort is to determine the future direction of water quality control for protection of California's waters. Development of these plans will satisfy four objectives as follows:

First, the plans are a requirement of the U.S.: Environmental Protection Agency in the allocation of federal grants to cities and districts for construction of wastewater treatment facilities.

Second, the plans will fulfill the requirements of the Porter-Cologne Act for water quality control plans.

Third, the plans will provide a basis for establishing priorities in the disbursement of both state and federal grants for the construction of upgrading of wastewater treatment facilities.

Fouth, the plans, by delineating water quality objectives to be achieved and maintained, will provide the basis for the establishment or revision of waste discharge permits by Regional Boards.

The plan embodied in this report is intended to provide a definitive program of actions designed to preserve and enhance water quality, and to protect beneficial uses in a manner which will result in maximum benefit to the people of the State for the next 25 to 30 years. In a sense, the water quality control plan is a melding of the state and federal requirements with the unique physical, economic and social conditions of the basin to yield the best practicable water quality management scheme presently attainable.

The plan consists of two major parts: Part I, which is herein presented, contains all the necessary elements of a water quality control plan in accordance with state and federal requirements; A separately bound Part II consists of planning information supportive to the control plan. In addition, four appendices to the report containing specific detailed information have been prepared these are: Appendix A, "Project Lists", Appendix B, "Changes in Water Quality Objectives", Appendix C, "Evidence of Public Participation", and Appendix D, "Surveillance".

Part I, the Water Quality Control Plan, will be adopted by the California Regional Water Quality Control Board, Central Coast Region and approved by the State Water Resources Control Board. This part consists of the identified beneficial water uses; water quality objectives; plan implementation program for meeting these objectives; an environmental assessment of the recommended plan; and a surveillance program to monitor the effectiveness of the plan.

Part II, Supporting Information, will not be adopted, but is presented to document the basic information, assumptions and alternatives considered in arriving at the recommended plan and to assist the public in the evaluation of the plan.

Although the intent of this comprehensive planning effort has been to provide positive and firm direction for water quality control for many years into the future, it is recognized that adequate provision must be made for changing conditions and technology. Thus, a major premise in the development of the basin plans has been that these plans will be maintained current. Revisions will be made at least annually. Unlike traditional plans which often become obsolete within a few years after their preparation, the comprehensive water quality control plans will be updated as deemed necessary to maintain pace with technology, policies, and physical changes in the basin.

The comprehensive water quality control plan program has been directed by the State Water Resources Control Board through the Division of Planning and Research in conjunction with the Central Coastal Regional Water Quality Control Board in San Luis Obispo. Frequent meetings, workshops and scheduled public briefings have been held to inform public agencies, the agricultural community and interested members of the public on the progress of the study. Arrangements for public meetings were made by the Regional Board Staff who also mailed meeting notices and arranged for newspaper, radio and television announcements of these meetings. Announced public meetings were held in the area to inform people of the study plan, beneficial uses and water quality objective, alternative water quality management plans and the recommended plan and evaluation methods.

The water quality control planning for the Central Coastal Region was conducted under contract with the State Water Resources Control Board by a consortium of three consulting engineers, Brown and Caldwell, Water Resources Engineers and Yoder-Trotter-Orlob, as a joint venture. The overall management for work in this and in two other basins of the state was provided by Frank Kersnar and a board of control made up of principal engineers from the consortium. Special consultants and sub contractors were also retained by the consortium for work on special topics. Management of the Central Coastal Basin work was provided by Richard C. Bain, Jr. As the basin had been divided into two study areas by previous contract arrangements between the State Water Resources Control Board and the Association of Monterey Area Governments (AMBAG) a deputy project manager was designated for each of two geographic areas. Mr. Lawrence Davis served in this capacity for the northern or AMBAG area, Mr. Davis of Yoder-Trotter-Orlob served as project engineer under the separate contract between AMBAG and the State. In the Southern area, Mr. Lynn Hartford served as Deputy Project Manager, assisted by Robert Hunter, Dave Dorn and John MacDiarmid. Subcontractors having major roles in this work included Herman D. Ruth Associates on population and land use, Jones and Stokes on environmental impact evaluations and Bartle Wells on municipal financing, governmental and implementation arrangements. Coordination was accomplished through liaison with Mr. Michael Campos and Mr. Glen Twitchell of the State Water Resources Control Board staff; considerable coordination and assistance was also provided by Mr. Thomas Bailey during his tenure with the Central Regional Board staff and later as Chief of Planning of the State Board staff, and by Mr. Kenneth Jones, executive officer of the Central Coastal Regional Water Quality Board and Mr. William Leonard and Mr. Brad Butt of his staff.

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CHAPTER 1. HISTORICAL BENEFICIAL USES

The Central Coastal Basin extending along the Pacific Ocean from Pescadero Point in San Mateo County to Rincon Point in Ventura County is shown in Figure 1-1. This narrow basin is generally mountainous with several intermountain valleys. Surface waters including coastal and fresh waters, provide habitat for many species of aquatic life and offer outstanding recreational opportunities. Water supplies for municipal, industrial, and agricultural uses are provided by surface water development and groundwater basins which in some cases are operated conjunctively with surface water conservation projects.

In spite of a relatively low population, there are several surface and groundwater quality problems throughout the 350 mile length of the Basin. The main problem is one of providing a sufficient amount of water of high quality to satisfy the demands of the beneficial uses and at the same time accommodating wastes generated in the Basin. The Basin planning effort has several objectives, but the primary goal is to develop an on-going program of procedures and physical works to protect and enhance the beneficial uses of the Central Coastal Basin waters.

This Chapter will present the historical beneficial uses of water that have been recognized and protected since 1967 when explicit water quality standards were derived for coastal and estuarine waters. Since 1967, the Interim Plan of 1971 presented beneficial uses to be protected for fresh water streams as well as coastal waters, and these were updated or reaffirmed in the revisions made to the interim plan in 1973. This historical pattern of protected water uses is traced below:

1967 STANDARDS

In 1967 the State of California, in response to a 1965 federal law, established water quality standards for its interstate and coastal waters.

Areas of the Central Coastal Basin covered by the 1967 standards were the coastal waters and contiguous waters subject to tidal influence. Three reaches of coastline were used to describe such waters in the Central Coastal Basin:

Rincon Point to Point Arguello

Point Arguello to Point Piedras Blancas

Point Piedras Blancas to Pescadero Point

Rincon Point to Point Arguello

Beneficial uses cited in the 1967 standards for the coastal waters between Rincon Point and Point Arguello were wildlife habitat, kelp harvesting, commercial fishing, sport fishing, industrial water supply and water-oriented recreation.

The coastline along southern Santa Barbara County is characterized by broad, flat sandy beaches. Recreationists are attracted to the coastline not only for its scenic attractiveness but also to pursue water-oriented recreational activities. Due to warmer water temperatures, this section of coastline is more hospitable than the rest of the Central Coastal Basin for water contact sports. The beaches are open to the public at many locations along this stretch of coastline.

Fish and wildlife habitat is provided by the marine waters along the entire reach of coastline from Rincon Point to Point Arguello, including San Miguel, Santa Rosa, and Santa Cruz Islands. Kelp, which is commercially harvested in this area, is very important to marine life as it provides both a sanctuary and a feeding ground for many forms of marine life.

Commercial and sport fishing from boats is popular and surf fishing is common on the beaches except for the coastline west of Isla Vista where private property limits access to the beaches.

General beach recreation is found along the entire coastline with concentrated use occurring at public beach areas. Swimming and boating take place at Carpenteria, Summerland, Santa Barbara, Arroyo Burro, Goleta, Elwood, El Capitan, Refugio, Gaviota, and Jalamo Beach Parks.

Point Arguello to Point Piedras Blancas

A number of beneficial uses were established for the coastal waters extending from Point Arguello to Point Piedras Blancas in the 1967 standards. Included are scenic enjoyment, fish and wildlife habitat, commercial and sport fishing, industrial water supply, navigation, scientific study, shell fish harvesting, and water-oriented recreation.

Because of the wide variety of beneficial uses, physical features of the coastline and access to the coastline, the area was divided into seven sections.

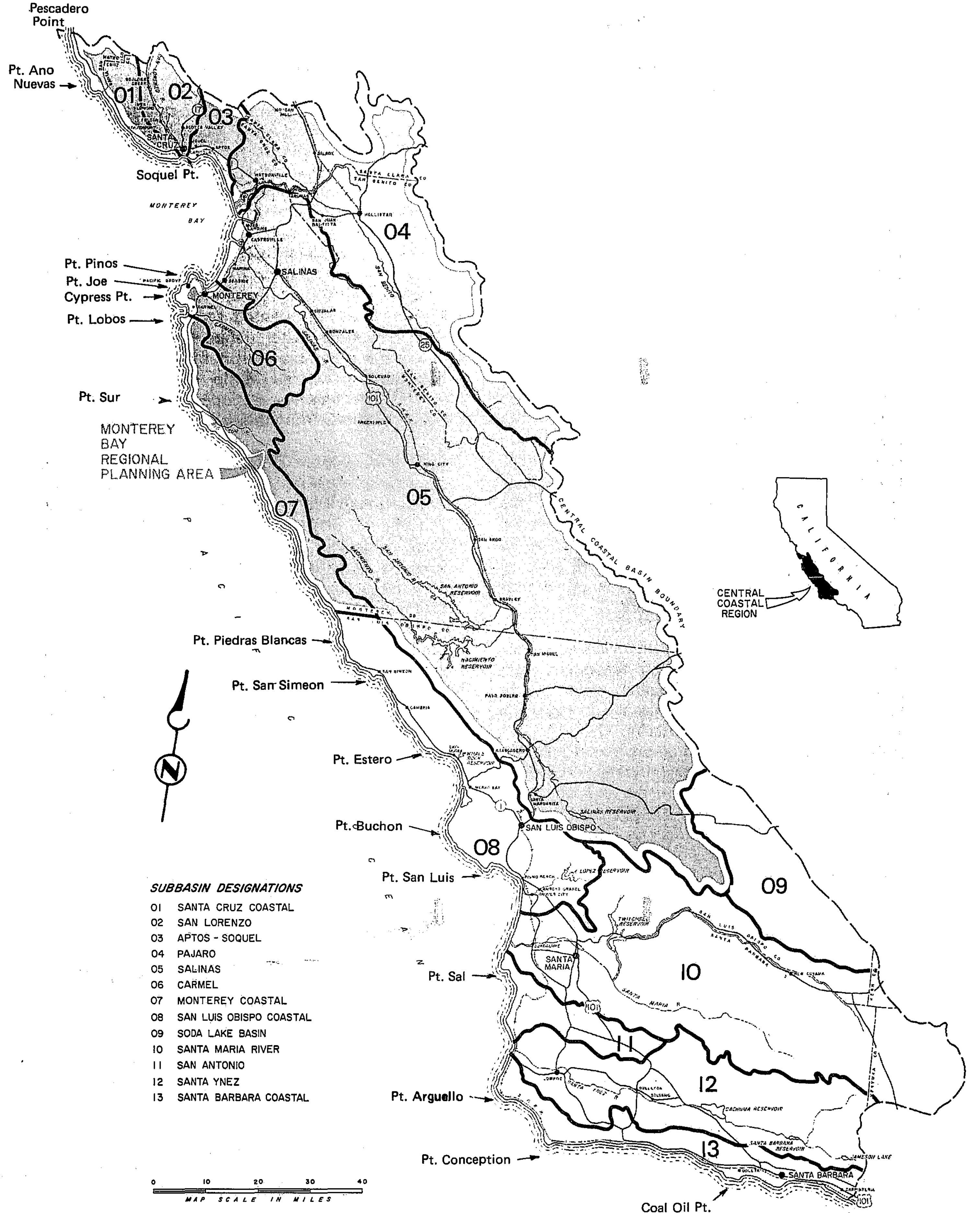


Fig. 1-1 Central Coastal Basin Hydrologic Subbasin Boundaries

I. Entire Coast Line - Point Arguello to Point Piedras Blancas:

Beneficial uses along the entire coastline are:

a. Scenic attractions and aesthetic enjoyment.

b. Marine habitat for sustenance and propagation of fish, other aquatic life and wildlife.

c. Fishing.

d. Industrial water supply.

e. Boating, shipping and navigation.

f. Scientific study.

II. Point Arguello - Point Sal:

The coastline consists of sandy beaches and relatively flat inland coastal plains. Rock outcroppings occur throughout the area. Access to the coastal waters is restricted in this area, except at Surf, because the coastline lies within Vandenberg Air Force Base. Dangerous surf conditions throughout the area prevent swimming and other water contact sports. A State Park at Point Sal is closed to public use because of military restrictions. Beneficial uses in this segment are:

a. General beach recreation in the vicinity of Surf.

b. Fishing in the vicinity of Surf.

III. Point Sal - Point San Luis:

The coastline between Point Sal and Shell Beach consists of broad sandy beaches and sand dunes inland from the ocean. The coast from Shell Beach to Point San Luis consists of rocky shores except in the vicinity of Avila. Access is generally unrestricted and extensive public use of the ocean occurs, especially near Oceano, Pismo Beach and Avila Beach. The shore line from Santa Maria River to Pismo Beach is an excellent clamming area. Water contact sports are common throughout this area. Beneficial uses in this segment are summarized by the following list:

a. General beach recreation.

b. Water contact sports (north of Santa Maria River).

c. Shellfish harvesting (south of Shell Beach to Santa Maria River).

d. Commercial unloading and processing of fish (in vicinity of public and private piers).

IV. Point San Luis - Point Buchon:

Steep cliffs and rocky shores make up this shoreline. Public access is extremely limited and recreational use is minor. Commercial harvesting of abalone occurs offshore in this area.

V. Point Buchon - Point Estero:

The shoreline consists of relatively flat sandy beaches, easily accessible to the public. State parks and beaches within this area include Montano de Oro State Park, Morro Bay State Park, Atascadero State Beach, Morro Strand State Beach and Cayucos State Beach. Estero Bay is used for recreational clamming. Abalone are taken in the vicinity of Point Buchon. Beneficial uses are summarized by the following list:

a. General beach recreation.

b. Swimming and other water contact sports.

c. Shellfish harvesting.

d. Habitat for bird life.

e. Commercial unloading and processing of fish (in vicinity of public and private piers).

VI. Point Estero - Point Piedras Blancas:

Rocky cliffs and sandy beaches make up the shoreline in this section. Public access is relatively easy at many points. Public parks and beaches in the area include Cambria County Park, San Simeon State Beach, Hearst Memorial State Park.

VII. Morro Bay:

Morro Bay is separated from the ocean by a long, narrow sand spit. The bay is about two and one-half miles long and one mile wide, including tide flats. It varies in depth from less than one foot at the southeast end to approximately twenty feet near the bay entrance.

Commercial oyster culture is a major use of Morro Bay, south of the public boat landing area and along the sand spit. Clams are taken on the mud flats in the bay. Recreational use, including swimming, boating, and fishing occurs on the entire bay. Beneficial uses made of Morro Bay include the following:

a. General beach recreation.

b. Swimming and other water contact sports.

c. Shellfish harvesting, including commercial growing and harvesting of oysters.

d. Habitat for bird life.

e. Small craft anchorage.

f. Recreational boating.

g. Commercial unloading and processing of fish (in vicinity of public and private piers).

Point Piedras Blancas to Pescadero Point

Several beneficial uses were established for the coastal waters between Point Piedras Blancas and Pescadero Point in the 1967 standards.

Beneficial uses along the coastline are summarized by the following list:

a. Scenic attractions and aesthetic enjoyment.

b. Marine habitat for sustenance and propagation of fish and wildlife.

c. Fishing.

d. Industrial water supply.

e. Boating, shipping and navigation

f. Scientific study.

g. General beach recreation, including swimming and other water contact activities.

h. Waterfowl habitat (Moss Landing and Elkhorn Slough).

i. Shellfish harvesting (Salinas River to Soquel Point and Elkhorn Slough).

Due to the wide variety of beneficial uses, physical features of the coastline and access to the coastline the area was further divided into five segments for purposes of describing the coastline:

1. Point Piedras Blancas - Point Lobos

2. Point Lobos - Santa Cruz

3. Santa Cruz - Pescadero Point

4. Moss Landing Harbor

5. San Lorenzo River Estuary

Point Piedras Blancas - Point Lobos

Rocky precipitous cliffs stretch for nearly one hundred miles along the coastline between Point Piedras Blancas and Point Lobos. Access to the shoreline along much of this particular section of coast is virtually impossible. However, several sandy beach areas and protected inlets provide access to the shore at certain points. The Los Padres National Forest encompasses most of the coastline between the Monterey-San Luis Obispo County line and Lime Kiln Creek. The State Division of Beaches and Parks operates and maintains the Pfeiffer Big Sur State Park and the Point Lobos State Reserve. The Big Sur State Park and the Point Lobos Reserve are open year-round and attract large numbers of people every year.

Point Lobos - Santa Cruz

From Point Lobos to the Monterey Pier the shore line consists mostly of large rock outcrops exposed to a heavy surf. Exceptions are sandy beaches in Carmel Bay and the Asilomar State Park. From the Monterey Pier to Santa Cruz the shoreline consists of broad sandy beaches.

The shoreline from Point Lobos to Santa Cruz with the exception of Fort Ord is readily accessible and much of it is in public ownership. Sections of the shoreline in public ownership include Carmel River State Beach, Carmel Beach, Asilomar State Beach, Monterey State Beach, Salinas River State Beach, Zmudowski State Beach, Moss Landing Jetties, Sunset State Beach, New Brighton State Beach, Manresa State Beach, Seacliff State Beach, Capitola State Beach, Twin Lakes State Beach and Rio del Mar Beach.

The cities of Pacific Grove, Monterey, Seaside and Santa Cruz are located on the shores of Monterey Bay and several other communities are located in the immediate vicinity. Ease of access and nearness of population centers result in a high degree of water oriented recreational uses, such as swimming, fishing and boating.

Santa Cruz - Pescadero Point

From Santa Cruz northward to Pescadero Point access to the coastline is available at most points and much of the coastline is in public ownership. The shoreline consists of sandy beaches with frequent rock outcroppings.

Public beach areas include Natural Bridges State Beach, Greyhound Rock and Gazos Creek Access Areas, Año Nuevo State Beach, Arroyo de Los Frijoles State Beach, Pebble Beach, and Pescadero Beach. In addition, most of the private land along this section of coastline is open to the public.

Moss Landing Harbor and Elkhorn Slough

Moss Landing Harbor is essentially a dredged waterway comprising the old Salinas River Estuary. It is separated from Monterey Bay by a narrow sand spit.

Elkhorn Slough is about six miles long and is the main tributary to Moss Landing Harbor. The slough is essentially a tidal estuary surrounded by mud flats and marshes.

San Lorenzo River Estuary

The San Lorenzo River is affected by tidal action upstream to approximately the Water Street Bridge in the City of Santa Cruz. The estuary is usually kept open to Monterey Bay in order to provide a recreation swimming area at the mouth of the river. This section of the San Lorenzo River channel has been modified to a rip-rap flood control channel. Detrimental effects of fish and wildlife have been reported by the Department of Fish and Game.

INTERIM PLAN

The interim plan for the Central Coastal Basin identified beneficial uses for fresh waters as well as coastal waters. Definitions of beneficial uses as contained in the interim plan are given as follows:

Municipal and Domestic Supply (MUN) - includes usual community use and individual use for domestic purposes.

Agricultural Supply (AGR) - includes crop, orchard and pasture irrigation, stock watering, and all uses in support of farming and ranching operations.

Industrial Supply (IND)

Groundwater Recharge (GRW) - recharge for later extraction for municipal, industrial, recreational and agricultural uses.

Water-Contact Recreation (REC 1) - all recreational uses involving actual body contact with water, such as swimming, wading, water sports - water skiing, skindiving, surfing, sport fishing - lake, stream, ocean.

Swimming (SWIM) - special recreational use.

Non-Water-Contact Recreation (REC 2) - recreational uses which involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, tidepool and marine life study, camping, aesthetic enjoyment, pleasure boating, and water-fowl hunting.

Boating (BOAT) - special recreational use.

Clamming and Shellfish

Harvesting (SHELL)

Commercial Fishing (COM)

Navigation (NAV) - includes commercial and naval shipping.

Scientific Study, Research and Training (SCI)

Marine Habitat (MAR) - provides habitat for fish propagation and sustenance, shrimp, crab, other shellfish, waterfowl, and other water-associated birds, and mammal rookery and hauling grounds.

Freshwater Habitat (FRSH) - provides freshwater habitat for fish, waterfowl and wildlife.

For reporting purposes, thirteen hydrographic units are used to describe beneficial uses of freshwaters in the Central Coastal Basin. Tables 1-1 and 1-2 show the beneficial uses of waters as reported in the Interim Plan.

Santa Cruz Coastal Sub-Basin

The Santa Cruz Coastal Sub-basin includes several small coastal drainages north west of the City of Santa Cruz to Pescadero Point. The headwaters of the creeks in this sub-basin are located in steep, heavily forested mountains. Along the coast, mountains are separated from sandy beaches by a sloping marine terrace with an average width of approximately one-half mile.

Table 1-1. Interim Plan Beneficial Uses - Inland Waters[a]

Sub-basin and watercourse	MUN	AGR	IND	REC 1	FRESH	SWIM	BOAT	REC 2	GRW
Santa Cruz Coastal Sub-basin									
Waddell Creek	X	X	X	X	X	X	X	X	X
Scott Creek	X	X	X	X	X	X	X	X	X
Little Creek	X	X	X	X	X	X	X	X	X
Big Creek	X	X	X	X	X	X	X	X	X
Mill Creek	X	X	X	X	X	X	X	X	X
San Vicente Creek	X		X	X	X			X	X
Liddell Creek, East Branch	X	X	X					X	
Laguna Creek	X	X	X	X	X	X	X	X	X
Majors Creek	X	X	X					X	X
San Lorenzo River Sub-basin									
Bean Creek	X	X	X	X	X	X	X	X	X
Boulder Creek	X	X		X	X	X	X	X	
Branciforte Creek	X	X		X	X	X		X	X
Carbonero Creek	X	X	X	X	X	X		X	
Lompico Creek	X	X		X	X	X		X	X
Newell Creek	X	X	X	X	X	X	X	X	X
Newell Creek Reservoir	X	X	X	X	X		X	X	X
San Lorenzo River	X	X	X	X	X	X	X	X	X
Zayante Creek	X	X	X	X	X	X	X	X	X
Soquel-Aptos Sub-basin									
Doyle Gulch	X	X	X	X	X	X	X	X	X
Soquel Creek	X	X	X	X	X	X	X	X	X
Hinckley Creek	X	X	X	X	X	X	X	X	X
Aptos Creek	X	X	X	X	X	X	X	X	X
Pajaro River Sub-basin, Santa Clara County									
Llagas Creek	X	X	X	X	X	X		X	X
Uvas Creek	X	X	X	X	X	X		X	X
Bodfish Creek	X	X		X	X			X	X
Pacheco Creek	X	X		X	X			X	X
Chesbro Reservoir		X		X	X	X	X	X	X
Uvas Reservoir		X		X	X	X	X	X	X
Pacheco Lake		X		X	X	X	X	X	X
Corralitos Creek	X	X	X	X	X			X	
Brown's Creek	X	X	X	X	X			X	
San Benito County									
Tres Pinos Creek	X	X	X	X	X			X	X
San Benito River		X		X	X			X	X
Hernandez Reservoir	X	X		X	X		X	X	X
Pajaro River	X	X	X	X	X	X	X	X	X
Salinas River Sub-basin									
Alisal Creek		X		X	X	X	X	X	X
Arroyo Seco	X	X	X	X	X	X	X	X	X
Estrella Creek	X	X		X	X			X	X
Gabilan Creek		X		X	X	X	X	X	X
Las Tablas Creek	X	X		X	X			X	X
Nacimiento River	X	X	X	X	X	X	X	X	X
San Antonio River	X	X	X	X	X	X	X	X	X
San Lorenzo Creek		X		X	X	X	X	X	X
San Marcos Creek	X	X		X	X	X	X	X	X
Santa Lucia Creek	X	X		X	X	X		X	X
Santa Rita Creek	X	X	X	X	X	X	X	X	X
Tassajara Creek	X	X		X	X	X		X	X
Elkhorn Slough			X	X	X		X	X	
Salinas River	X	X	X	X	X	X	X	X	X
Carmel River Sub-Basin									
Carmel River	X	X	X	X	X	X		X	X
Tularcitos Creek	X	X		X	X			X	X
San Clemente Creek	X	X		X	X			X	X
Cachaqua Creek	X	X	X	X	X	X	X	X	X
Laguna de Rey				X	X	X	X	X	X

Sub-basin and watercourse	MUN	AGR	IND	REC 1	FRESH	SWIM	BOAT	REC 2	GRW
Monterey Coastal Sub-basin									
San Jose Creek	X	X		X				X	X
Palo Colorado Canyon	X	X		X		X		X	X
Little Sur River	X			X	X	X		X	X
Big Sur River				X	X	X		X	X
Limekiln Creek	X	X		X	X			X	X
San Luis Obispo Coastal Sub-basin									
San Carpoforo Creek	X	X	X	X	X	X	X	X	X
Arroyo de la Cruz	X	X	X	X	X	X	X	X	X
Burnett Creek	X	X		X	X	X	X	X	X
Pico Creek	X	X		X	X			X	X
San Simeon Creek	X	X	X	X	X	X	X	X	X
Steiner Creek	X	X		X	X	X		X	X
Santa Rosa Creek	X	X	X	X	X	X	X	X	X
Cayucos Creek	X	X		X	X			X	X
Old Creek	X	X	X	X	X	X	X	X	X
Toro Creek	X	X		X	X			X	X
Morro Creek	X	X		X	X	X	X	X	X
Chorro Creek	X	X	X	X	X	X	X	X	X
Los Osos Creek	X	X		X	X			X	X
San Luis Obispo Creek	X	X	X	X	X	X	X	X	X
Pismo Creek	X	X	X	X	X	X	X	X	X
Arroyo Grande Creek	X	X	X	X	X	X	X	X	X
Lopez Creek	X	X	X	X	X	X	X	X	X
Lopez Reservoir	X	X	X	X	X	X	X	X	X
Soda Lake Sub-basin									
Unnamed tributary	X	X	X	X	X	X	X	X	X
San Antonio Creek Sub-basin									
San Antonio Creek	X	X		X	X	X	X	X	X
Santa Maria River Sub-basin									
Cuyama River	X	X		X	X	X	X	X	X
Huasna River	X	X		X	X			X	
Alamo Creek		X		X	X			X	X
Sisquoc River	X	X		X	X	X	X	X	X
Santa Ynez River Sub-basin									
Agua Caliente Canyon	X	X	X	X	X			X	
Alama Pintado Creek	X	X	X	X	X			X	X
El Jaro Creek	X	X	X	X	X	X	X	X	X
Indian Creek	X	X	X	X	X			X	
Lompoc Canyon	X	X	X	X	X	X		X	X
Mono Creek	X	X	X	X	X			X	X
Oak Canyon	X	X	X	X	X	X		X	X
Salsipuedes Creek	X	X	X	X	X	X	X	X	X
Santa Cruz Creek	X	X	X	X	X		X	X	X
Santa Rita Creek	X	X	X	X	X	X		X	X
Santa Ynez River	X	X	X	X	X	X	X	X	X
Santa Barbara Coastal Sub-basin									
Glen Anne Creek	X	X		X	X		X	X	X
Atascadero Creek	X	X		X	X		X	X	X
San Jose Creek	X	X		X	X		X	X	X
San Antonio Creek	X	X		X	X			X	X
Franklin Creek								X	X
Carpinteria Creek				X	X		X	X	X
Rincon Creek				X	X			X	

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

Table 1-2. Interim Plan Beneficial Uses - Coastal Waters[a]

Coastal waters	SCI	SHELL	IND	REC 1	MAR	COM	SWIM	NAV	REC 2
Pescadero Pt. to Pt. Piedras Blancas	X		X	X	X	X	X	X	X
Salinas River to Soquel Pt.	X	X	X	X	X	X	X	X	X
San Lorenzo River Estuary				X	X	X	X	X	X
Santa Cruz Harbor			X	X	X	X		X	X
Elkhorn Slough	X	X	X	X	X	X	X	X	X
Monterey Harbor			X	X	X	X		X	X
Piedras Blancas to Pt. Arguello	X		X	X	X	X		X	X
Pt. Piedras Blancas to Pt. Estero	X			X	X	X	X	X	X
Estero Bay (Morro Bay)	X	X	X	X	X	X	X	X	X
Pt. Buchon to Pt. San Luis	X		X	X	X	X	X	X	X
Pt. San Luis to Point Sal	X	X	X	X	X	X	X	X	X
Pt. Sal to Pt. Arguello	X			X	X	X		X	X
Pt. Arguello to Rincon Pt.	X	X[b]	X	X	X	X		X	X
Coal Oil Pt. to Rincon Pt.	X		X	X	X	X	X	X	X
Santa Barbara Harbor			X	X	X			X	X
Beach Parks				X	X		X	X	X

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

[b] Areas not well defined.

Water supplies for municipal, agricultural and industrial purposes are provided by the creeks and groundwater basins within the sub-basin but these uses are small.

Coastal streams support runs of steelhead trout, as well as resident trout. Waddell, Scott, San Vicente and Laguna Creeks, provide 40 miles of anadromous fish habitat.

San Lorenzo River Sub-Basin

The San Lorenzo River Sub-basin covers an area of 140 square miles and is located in Santa Cruz County. The San Lorenzo River flows through rugged, mountainous terrain, which is heavily forested, to the ocean at Santa Cruz. Major tributaries include Boulder Creek, Newell, Lompico, Zayante, Bean, and Branciforte Creeks.

The San Lorenzo River is developed for municipal water supply purposes. Loch Lomond Reservoir on Newell Creek, a tributary of the San Lorenzo River, provides a good quality supply for the City of Santa Cruz. Small agricultural and industrial demands are met by surface and groundwater diversions.

Steelhead and silver salmon habitat is provided by the San Lorenzo River and its main tributaries including Branciforte, Zayante, Bean, Fall, Love, and Boulder Creeks. These waterways provide over 130 miles of habitat for these fishes. Also the San Lorenzo system supports a resident trout fishery.

Recreationists use the San Lorenzo River, especially the lower reaches, for swimming and wading.

Aptos - Soquel Creeks Sub-Basin

The Aptos-Soquel Creeks Sub-basin, which lies entirely within Santa Cruz County, contains rugged mountains in the north yielding to rolling hills and a well developed marine terrace along the coast. Major streams are Soquel and Aptos creeks.

Municipal, industrial and agricultural water demands are met through development of the sub-basin's surface and groundwater.

Only 17 miles of Soquel Creek and 5 miles of Aptos Creek are considered suitable for steelhead trout.

Pajaro River Sub-Basin

The Pajaro River Sub-basin is mountainous with flat lands confined to the flood plains of the Pajaro River, Llagas, Uvas, and Pescadero Creeks and the San Bernito River.

The Pajaro River Sub-basin provides substantial quantities of water for municipal, indistrial and agricultural purposes. All existing surface water developments are used to recharge groundwater basins.

Steelhead trout use 30 miles of the Pajaro River and about 120 miles of streams that are tributary to the Pajaro River. The Pajaro River is one of the most important steelhead fishing streams in the Central Coastal Basin along with San Lorenzo and Carmel Rivers.

Salinas River Sub-Basin

The Salinas Valley is the largest valley in the California coastal range. The sub-basin, drained to Monterey Bay by the Salinas River, exhibits terrain ranging from rugged mountains to marsh lands in the Elkhorn Slough area.

Two major tributaries to the Salinas River recharge the large groundwater basin in the Salinas Valley from Bradley to Castroville. Storage projects on the San Antonio and Nacimiento Rivers are operated to facilitate recharge of the groundwater basin. The greatest agricultural demands for water in the Central Coastal Basin are exerted in the Salinas River Sub-basin.

The Salinas River System supports both cold water and warm water fisheries. Elkhorn Slough, the second largest salt marsh in California, provides important wildlife habitat.

Carmel River Sub-Basin

The Carmel River Sub-basin with a total area of 250 square miles lies entirely within Monterey County.

The Carmel River is the primary source of water for the municipal and industrial needs of Monterey Peninsula including the communities of Pacific Grove and Monterey. Two reservoirs are operated conjunctively with the groundwater basin to supply excellent quality water. Small agricultural demands are met by pumping groundwater in the lower Carmel Valley.

About 70 miles of the Carmel River system are classed as suitable for steelhead trout. A small marsh at the mouth of the Carmel River is an important bird sanctuary.

Monterey Coastal Sub-Basin

The terrain of the Monterey Coastal Sub-basin is mountainous, interlaced with several short streams draining to the Pacific Ocean. The principal stream is the Big Sur River.

Very small municipal and agricultural demands are met by development of surface water and groundwater.

Coastal streams provide a limited amount of habitat for steelhead trout with the Big Sur and Little Sur rivers each providing about 13 miles of habitat.

San Luis Obispo Coastal Sub-Basin

The San Luis Obispo Coastal Sub-basin is characterized by mountainous terrain with small stream valleys and the more expansive Arroyo Grande and San Luis Obispo Valleys.

Municipal, industrial and agricultural water requirements are met by both surface water and groundwater development. Lopez, Whale Rock and Salinas Reservoirs provide substantial quantities of water.

Steelhead trout enter coastal streams north of Pismo Creek. About 240 miles of waterways are deemed usable by steelhead. Resident trout are found throughout this Sub-basin and warm water fish are found in Lopez Reservoir.

Soda Lake Sub-Basin

The Soda Lake Sub-basin is a large enclosed basin located in the southeasterly portion of San Luis Obispo County. The only supply of water available in the Sub-basin is groundwater.

There are no existing surface water projects in the Soda Lake Sub-basin. All municipal, and agricultural water requirements are met by individual wells.

Santa Maria River Sub-Basin

The Santa Maria River Sub-basin comprises 1,850 square miles and is drained by the Santa Maria River. The two principal tributaries are the Cuyama and Sisquoc rivers.

Twitchell Dam on the Cuyama River is operated to recharge the groundwater basin in the Santa Maria Valley. Municipal and agricultural water requirements are met by pumping groundwater basins.

Both water-contact and non-contact recreational activities occur in the Santa Maria River Sub-basin. Cold water fish are found in the surface waters.

San Antonio Creek Sub-Basin

The San Antonio Creek Sub-basin covers an area of 211 square miles and lies in the west-central part of Santa Barbara County. San Antonio Creek is the major stream in the sub-basin.

Groundwater development provides supplies for agriculture and municipal uses with Vandenberg Air Force Base accounting for most of the municipal use.

Santa Ynez River Sub-Basin

The Santa Ynez River Sub-basin covers 900 square miles in Santa Barbara County. Elevations range from sea level at the mouth of the Santa Ynez River to over 4,000 feet near the eastern boundary of Santa Barbara County.

Juncal Dam, forming Jameson Lake, Gibralter Dam, and Cachuma Dam on the Santa Ynez River are the major surface water projects in the sub-basin. These projects provide substantial amounts of water for municipal and industrial purposes. Groundwater basins also provide water supplies for municipal, industrial and agricultural uses.

Most of the streams in the Santa Ynez River Sub-basin support recreational activities and cold water fisheries. A warm water fishery is established in Cachuma Lake.

Santa Barbara Coastal Sub-Basin

The Santa Barbara Coastal Sub-basin is a narrow strip of land south of the Santa Ynez Mountains, extending eastward from Point Arguello to the Ventura County line. Elevated alluvial terraces typify the topography of this sub-basin. The terraces slope toward the ocean and terminate at the coastline in steep cliffs 50 to 150 feet high.

The major portion of the water supply requirements in the Santa Barbara Coastal Sub-basin are currently being met from surface water storage in the Santa Ynez River Sub-basin. Groundwater development in the sub-basin provides for a portion of the municipal and agricultural requirements.

Almost all streams in the Santa Barbara Coastal Sub-basin offer recreational opportunities.

WATER QUALITY CONTROL PLAN OF 1973

Revisions to the Interim Plan for the Central Coastal Basin did not involve additions or deletions of beneficial uses for any of the water bodies in the Basin. Consequently, the most up-to-date list of beneficial uses for the Basin is represented by Tables 1-1 and 1-2.

Chapter 2 Present and Potential Beneficial Uses

Establishing the beneficial uses to be protected in the Central Coastal Basin is a cornerstone of this Comprehensive Plan. Once the uses are recognized, compatible water quality standards can be established as well as the level of treatment necessary to maintain the standards and ensure the continuance of the beneficial uses. This chapter will examine and identify the historical, present and potential beneficial uses in the Basin.

SELECTION CONSIDERATIONS

Any of three conditions could require that historical beneficial use descriptions for particular water bodies be changed. The first is the purely procedural, administrative situation in which user designations are redefined. This has indeed happened during the basin planning process, the State Board having approved a new list of beneficial use designations. Accordingly, the beneficial uses of the Central Coastal Basin waters are changed somewhat in this chapter to reflect the new definitions of terms.

A second condition that may arise to warrant a change in beneficial uses in a particular watershed is an evolving demand that places use pressure on a water body not experienced previously. For example, agricultural irrigation with either groundwater or surface water in a particular watershed may now be practiced where previously it was not. In such a case the agricultural water use should be added for the watershed in question, and the water quality objectives necessary to protect the water for that use should come into force.

The third condition, the possibility of eliminating historical use, has two subparts, one that is reasonable and defensible, and a second that is to be avoided. First a particular use may simply vanish (e.g., a community may find another water supply) in which case continuance of that use on the list for the water in question is simply irrelevant and unnecessary. Hence, it could be dropped. (Allowing quality to degrade below historical levels, however, simply because a use and its attendant quality objectives are removed is not justifiable on the grounds of the removal alone.) The second subpart of the condition of elimination of uses is the undesirable condition to which quality has been degraded by other users or other situations to the point that the subject use is no longer adequately protected and hence must be removed from the list or even prohibited by law. In the Central Coastal Basin the posting of beaches at both Carmel and Santa Cruz at times in the past as a result of unsafe levels of bacterial contamination is probably the best example, although this has not resulted in dropping recreation permanently from the list of beneficial uses of beach areas at these locations.

Uses of waterways in the Central Coastal Basin have not been reduced in any case in the basin planning work reported here, but diligence is required from all affected parties to assure that this does not become necessary for other than the defensible reasons of elimination or transference of a given use for technological, economic or social reasons of voluntary choice.

In addition to guidance by 1) historical uses to be preserved and 2) increased demands requiring an additional use designation, another criterion that could be used for adding uses is the ability of a water to support additional uses in the future by virtue of the adequacy of existing quality. For example, a stream might be designated as available for municipal water supply because its quality is suitable for such use today, even though it is not currently being so used. In that case, the stream would be protected for this use for future generations who may need or choose to use that stream as a municipal supply. While this possibility exists, it was not used for the Central Coastal Basin, since all uses designated are now in effect to some degree.

The remainder of this chapter summarizes current beneficial uses from the material presented in Chapter 1, describes anticipated future water demands characterizing future or potential water users, and lists the present and potential beneficial uses in tabulated form.

PRESENT USES

Current beneficial uses may be broadly categorized as water supply, recreation, fish and wildlife habitat, navigation, commercial fishing and scientific study.

Urban water use is spread fairly uniformly throughout the Central Coastal Basin with 53 percent of the urban water use estimated for 1970 occurring in the AMBAG portion of the Basin. Agricultural water use is concentrated mainly in the Salinas, Pajaro and Santa Maria River valleys where 70 percent of the waters used for agriculture occurs in those areas.

Recreational use occurs in all sub-basins with ocean beaches and coastal waters receiving a high percentage of water-oriented recreational use. Major rivers providing recreational opportunities include the San Lorenzo, Carmel, Salinas, Pajaro, Big Sur, Cuyama, and Santa Yzez rivers. Reservoirs including the Nacimiento, San Antonio, Lopez, Whale Rock, Twitchell, and Cachuma reservoirs provide additional fresh surface water acreage for recreationists. Activities are varied with fishing and swimming popular on the streams and fishing, sailing, clamdigging, skin-diving, and beach combing predominate in the coastal areas. The more passive activities, including sightseeing, are important throughout the entire Basin.

Fish and wildlife habitat is common in the Basin supporting a wide variety of life. Coastal waters and streams support anadromous fish, which provide important sport and commercial fisheries. Other ocean fisheries, such as rock fish and squid, are also important and they are taken by sport and commercial fishermen. Fishing fleets operate out of Santa Cruz, Moss Landing, Monterey, Morro Bay and Santa Barbara. Shellfishing is popular at many locations along the coast. Elkhorn Slough, Morro Bay, Goleta Slough and lagoons at certain river mouths, such as the Salinas and Carmel rivers, are important wildlife areas, especially to waterfowl and other water associated birds.

Navigation is fairly important to the economy of the Central Coastal Basin. Harbors at Santa Cruz, Moss Landing, Monterey, Morro Bay and Santa Barbara provide facilities for sailboats, fishing boats and other pleasure craft.

Scientific studies are concentrated in areas along the coastline where there are three refuges and one marine reserve. Included are the Hopkins Marine Life, Pacific Grove Marine Gardens, and California Sea Otter Game refuge and the Point Lobos State Reserve. The Sea Otter Refuge occupies a major portion of the coastline, about 100 miles, in Monterey County and the northerly third of San Luis Obispo County.

PROJECTED WATER DEMANDS

Additional demands will be placed on the water resources of the Basin to supply more water for future residential, commercial, industrial and agricultural developments, to accommodate a higher recreational demand, and to produce more fish and wildlife to satisfy increased sport fishing and hunting interests and commercial fishing demands. At the same time, the aesthetic beauty of the Basin and its waters must be protected and in some cases enhanced.

The greatest demands for local water supply will occur in the Santa Cruz, South Monterey Bay, Salinas, Gilroy, San Luis Obispo, Santa Maria, Lompoc and Santa Barbara areas. The greatest increases are projected for the Gilroy area where urban water use in 2000 is forecast to be five times greater than it was in 1970. In the Salinas and Santa Barbara areas, urban water use is expected to triple over the next 30 years. Agricultural water requirements will increase 20 percent throughout the Basin over the next 30 years with the greatest percentage increases occurring in the Pajaro, Upper Salinas and Santa Maria Valleys. Future urban and agricultural water demands will exert even more pressure on local areas which are already experiencing water quality problems due to heavy water use.

Recreation demands for the Basin are expected to be about 47 million visitor-days annually by the year 2000 and the ocean and coastal areas will receive the major portion of the demand. Fishing is expected to increase from 2 million angler-days in 1970 to about 31.6 million angler-days by the year 2000 with ocean fishing increasing more rapidly than fresh water fishing. The commercial fishing will be expected to provide more fish for human consumption. A certain percentage of the increased demands can be met through changes in fishing methods, areas fished and species taken. However, the increased demands for salmon and steelhead will undoubtedly require that the coastal streams currently used by these anadromous fish must yield more fish, even if they must be increasingly stocked from hatcheries.

Potential Beneficial Uses

Beneficial uses are presented for inland waters by 13 sub-basins in Table 2-1. Beneficial uses of coastal waters are shown in Table 2-2. Discussions of beneficial uses in Chapter 1 were built around the same areal designations. Groundwaters throughout the Central Coastal Basin, except for that found in the Soda Lake Sub-basin, are suitable for agricultural water supply, municipal and domestic water supply and industrial use.

The categories of use and definitions are somewhat different than those used in the past.

Table 2-1. Present and Anticipated Future Uses of Inland Surface Waters[a]

Sub-Basin and watercourse	Municipal and domestic supply	Agricultural supply	Industrial process supply	Industrial service supply	Groundwater recharge	Water contact recreation	Non-water contact recreation	Wildlife habitat	Cold fresh-water habitat	Warm fresh-water habitat	Fish migration	Fish spawning
Santa Cruz Coastal Sub-Basin												
Waddell Creek	X	X		X	X	X	X	X	X		X	X
Scott Creek	X	X		X	X	X	X	X	X		X	X
Little Creek	X	X		X	X	X	X	X				
Big Creek	X	X		X	X	X	X	X				
Mill Creek	X	X		X	X	X	X	X				
San Vicente Creek	X			X	X	X	X	X	X		X	X
Liddel Creek, East Branch	X	X		X			X					
Laguna Creek	X	X		X	X	X	X	X	X		X	X
Majors Creek	X	X		X	X		X					
San Lorenzo River Sub-Basin												
Bean Creek	X	X		X	X	X	X	X	X		X	X
Boulder Creek	X	X				X	X	X	X		X	X
Branciforte Creek	X	X			X	X	X	X	X		X	X
Carbonero Creek	X	X		X			X	X	X			
Lompico Creek	X	X			X	X	X	X	X			
Newell Creek	X	X		X	X	X	X	X	X			
Newell Creek Reservoir	X	X		X	X	X	X	X	X			
San Lorenzo River	X	X		X	X	X	X	X	X		X	X
Zayante Creek	X	X		X	X	X	X	X	X		X	X
Soquel-Aptos Sub-Basin												
Doyle Gulch	X	X		X	X	X	X	X				
Soquel Creek	X	X		X	X	X	X	X	X		X	X
Hinckley Creek	X	X		X	X	X	X	X				
Aptos Creek	X	X		X	X	X	X	X	X		X	X
Pajaro River Sub-Basin												
Llagas Creek	X	X		X	X	X	X	X	X	X	X	X
Uvas Creek	X	X		X	X	X	X	X	X	X	X	X
Bodfish Creek	X	X			X	X	X	X		X		
Pacheco Creek	X	X			X	X	X	X	X	X	X	X
Chesbro Reservoir		X			X	X	X	X		X		
Uvas Reservoir		X			X	X	X	X		X		
Pacheco Lake		X			X	X	X	X		X		
Corralitos Creek	X	X		X		X	X	X	X	X	X	X
Brown's Creek	X	X		X		X	X	X		X		
Tres Pinos Creek	X	X		X	X	X	X	X		X		
San Benito River		X			X	X	X	X		X		
Hernandez Reservoir	X	X			X	X	X	X		X		
Pajaro River	X	X		X	X	X	X	X	X		X	X
Salinas River Sub-Basin												
Alisal Creek		X			X	X	X	X				
Arroyo Seco	X	X		X	X	X	X	X	X		X	X
Estrella Creek	X	X			X	X	X	X				
Gabilan Creek		X			X	X	X	X				
Las Tablas Creek	X	X			X	X	X	X				
Nacimiento River	X	X		X	X	X	X	X	X	X		
Pancho Rico Creek	X	X			X		X	X				
San Antonio River	X	X		X	X	X	X	X	X	X		
San Lorenzo River		X			X	X	X					
San Marcos Creek	X	X			X	X	X	X				
Santa Lucia Creek	X	X			X	X	X	X				
Santa Rita Creek	X	X		X	X	X	X	X				
Tassajara Creek	X	X			X	X	X	X				
Elkhorn Slough				X		X	X	X				
Salinas River, upstream[b]	X	X		X	X	X	X	X	X	X	X	
Salinas River, downstream[b]							X	X		X	X	
Carmel River Sub-Basin												
Carmel River	X	X		X	X	X	X	X	X		X	X
Tularcitos Creek	X	X			X	X	X	X				
San Clemente Creek	X	X			X	X	X	X				
Cachagua Creek	X	X	X	X	X	X	X	X	X	X	X	X
Laguna de Rey					X	X	X	X				
Monterey Coastal Sub-Basin												
San Jose Creek	X	X			X	X	X					
Palo Colorado Canyon	X	X			X	X	X					
Little Sur River	X				X	X	X	X	X		X	X
Big Sur River					X	X	X	X	X		X	X
Limekiln Creek	X	X			X	X	X	X	X		X	X

Table 2-1. Present and Anticipated Future Uses of Inland Surface Waters[a] (Continued) (2)

Sub-Basin and watercourse	Municipal and domestic supply	Agricultural supply	Industrial process supply	Industrial service supply	Groundwater recharge	Water contact recreation	Non-water contact recreation	Wildlife habitat	Cold fresh-water habitat	Warm fresh-water habitat	Fish migration	Fish spawning
San Luis Obispo Coastal Sub-Basin												
San Carpoforo Creek	X	X		X	X	X	X	X	X	X	X	X
Arroyo de la Cruz Creek	X	X		X	X	X	X	X	X	X	X	X
Burnett Creek	X	X			X	X	X	X		X		
Pico Creek	X	X			X	X	X	X	X	X	X	X
San Simeon Creek	X	X		X	X	X	X	X	X	X	X	X
Stenner Creek	X	X			X	X	X	X		X		
Santa Rosa Creek	X	X		X	X	X	X	X	X	X	X	X
Cayucos Creek	X	X			X	X	X	X	X	X	X	X
Old Creek, downstream[c]		X			X	X	X	X				
Whale Rock Reservoir	X	X	X	X	X	X	X	X	X	X		
Old Creek, upstream[c]	X	X	X	X	X	X	X	X	X	X		
Toro Creek	X	X			X	X	X	X	X	X	X	X
Moro Creek	X	X			X	X	X	X	X	X	X	X
Chorro Creek	X	X		X	X	X	X	X	X	X	X	X
Los Osos Creek	X	X			X	X	X	X	X	X	X	X
San Luis Obispo Creek	X	X		X	X	X	X	X	X	X	X	X
Pismo Creek	X	X		X	X	X	X	X	X	X	X	X
Arroyo Grande Creek, downstream[d]	X	X		X	X	X	X	X		X	X	
Lopez Reservoir	X	X	X	X	X	X	X	X	X	X		
Arroyo Grande Creek, upstream[d]	X	X	X	X	X	X	X	X	X	X		
Soda Lake Sub-Basin												
Sandiego Creek	X	X			X		X	X		X		
Soda Lake[e]	X	X		X	X	X	X	X		X		
Santa Maria River Sub-Basin												
Santa Maria River	X	X		X	X	X	X	X		X		
Cuyama River, downstream[f]	X	X			X	X	X	X		X		
Twitchell Reservoir	X	X			X		X	X		X		
Cuyama River, upstream[f]	X	X			X		X	X		X		
Huasna River	X	X				X	X	X		X		
Alamo Creek		X			X	X	X	X		X		
Sisquoc River	X	X			X	X	X	X	X	X		
San Antonio Creek Sub-Basin												
San Antonio Creek	X	X			X	X	X	X	X	X		
Santa Ynez River Sub-Basin												
Agua Caliente Canyon	X	X		X		X	X	X		X		
Alama Pintado	X	X		X	X	X	X	X		X		
El Jaro Creek	X	X		X	X	X	X	X		X		
Indian Creek	X	X		X		X	X	X		X		
Lompoc Canyon	X	X		X	X	X	X	X		X		
Mono Creek	X	X		X	X	X	X	X		X		
Oak Canyon	X	X		X	X	X	X	X		X		
Salsipuedes Creek	X	X		X	X	X	X	X	X	X	X	X
Santa Cruz Creek	X	X		X	X	X	X	X		X		
Santa Rita Creek	X	X		X	X	X	X	X		X		
Santa Ynez River, downstream[g]	X	X			X	X	X	X		X		
Cachuma Reservoir	X	X	X		X	X		X	X	X		
Santa Ynez River, upstream[g]	X	X	X	X	X	X	X	X	X	X		
Gibraltar Reservoir	X	X	X		X	X	X	X	X	X		
Jameson Lake	X	X	X		X	X	X	X	X	X		
Santa Barbara Coastal Sub-Basin												
Glen Anne Creek	X	X			X	X	X	X		X		
Atascadero Creek	X	X			X	X	X	X		X		
San Jose Creek	X	X			X	X	X	X	X	X		
San Antonio Creek	X	X			X	X	X	X		X		
Franklin Creek					X		X	X				
Carpinteria Creek					X	X	X	X		X		
Rincon Creek						X	X	X	X	X		
Tecolate Creek					X	X	X	X	X	X		

[a] See Fig. 9-1 for location. This table lists only relatively major streams and tributaries and is not a complete inventory for the Central Coastal Region. Minor streams and tributaries not specifically named have implied beneficial use designations such that, unless justification to the contrary can be given, both recreation and aquatic life are protected.

[b] From Spreckles gage

[c] From Whale Rock Reservoir

[d] From Lopez Reservoir

[e] Soda Lake is also a saline water habitat.

[f] From Twitchell Reservoir

[g] From Cachuma Reservoir

Table 2-2. Present and Anticipated Future Uses of Coastal Waters

Coastal waters	Water contact recreation	Non-contact water recreation	Industrial service supply	Navigation	Marine habitat	Shellfish harvesting	Ocean commercial and sport fishing	Preservation of rare and endangered species	Area of special biological significance
Pescadero Pt. to Pt. Piedras Blancas	X	X	X	X	X	X	X	X	X
Pt. Ano Nuevo to Soquel Pt.	X	X	X	X	X	X	X		X
Soquel Pt. to Salinas River	X	X	X	X	X	X	X	X	
Salinas River to Pt. Pinos	X	X	X	X	X	X	X		X
Santa Cruz Harbor	X	X	X	X	X		X		
San Lorenzo Estuary	X	X		X	X		X		
Elkhorn Slough	X	X	X	X	X	X	X	X	
Monterey Harbor	X	X	X	X	X	X	X	X	
Pt. Sur	X	X			X	X	X		X
Pt. Piedras Blancas to Pt. Estero	X	X		X	X	X	X		
Estero Bay (including Morro Bay)	X	X	X	X	X	X	X	X	
Pt. Buchon to Pt. San Luis	X	X	X	X	X	X	X		
Pt. San Luis to Pt. Sal	X	X	X	X	X	X	X	X	
Pt. Sal to Pt. Arguello	X	X		X	X	X	X		
Pt. Arguello to Coal Oil Pt.	X	X	X	X	X	X	X		
Coal Oil Pt. to Rincon Pt.	X	X	X	X	X	X	X	X	
Santa Barbara Harbor	X	X	X	X	X		X		
Beach Parks	X	X		X	X				
San Miguel Island		X		X	X	X	X		X
Santa Rosa Island		X			X	X	X		X
Santa Cruz Island		X			X	X	X		X

However, there should be sufficient descriptions in the preceding pages to enable one to follow the transition from past designations to those presented herein.

Beneficial Use Definitions

The following are the beneficial uses for surface and groundwaters. The listing is based on the many uses shown in the interim reports and incorporates the comments of the basin contractors, the regional boards, the Office of Technical Coordination of the State Water Resources Control Board and State Board staff. One of the principal purposes of this standardization is to facilitate establishment of both qualitative and numerical water quality objectives that will be compatible on a statewide basis.

Municipal and Domestic Supply (MUN) - Includes usual uses in community or military water systems and domestic uses from individual water supply systems.

Agricultural Supply (AGR) - Includes crops, orchard and pasture irrigation, stock watering, support of vegetation for range grazing and all uses in support of farming and ranching operations.

Industrial Process Supply (PROC) - Includes process water supply and all uses related to the manufacturing of products.

Industrial Service Supply (IND) - Includes uses that do not depend primarily on water quality such as mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection and oil well repressurization.

Groundwater Recharge (GWR) - Natural or artificial recharge for future extraction for beneficial uses and to maintain salt balance or halt salt water intrusion into freshwater aquifers.

Navigation (NAV) - Includes commercial and naval shipping.

Water Contact Recreation (REC-1) - Includes all recreational uses involving actual body contact with water, such as swimming, wading, waterskiing, skindiving, surfing, sport fishing, uses in therapeutic spas and other uses where ingestion of water is reasonably possible.

Non-Contact Water Recreation (REC-2) - Recreational uses that involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, camping, pleasure boating, tidepool and marine life study, hunting and aesthetic enjoyment in conjunction with the above activities as well as sightseeing.

Ocean Commercial and Sport Fishing (COMM) - The commercial collection of various types of fish and shellfish, including those taken for bait purposes, and sport fishing in oceans, bays, estuaries and similar non-freshwater areas.

Warm Freshwater Habitat (WARM) - Provides a warm water habitat to sustain aquatic resources associated with a warm water environment.

Cold Freshwater Habitat (COLD) - Provides a cold water habitat to sustain aquatic resources associated with a cold water environment.

Preservation of Areas of Special Biological Significant (BIOL) - Includes marine life refuges, ecological reserves and designated areas of special biological significance, such as areas where kelp propogation and maintenance are features of the marine environment requiring special protection.

Areas of Special Biological Significance (ASBS) - are those areas designated by the State Water Resources Control Board as requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable. Such a designation implies the following requirements:

Discharge of elevated temperature wastes in a manner that would alter water quality conditions from those occurring naturally will be prohibited.

Discharge of discrete, point source sewage or industrial process wastes in a manner that would alter water quality conditions from those occurring naturally will be prohibited.

Discharge of waste from non-point sources, including but not limited to storm-water runoff, silt and urban runoff, will be controlled to the extent practicable. In control programs for waste from non-point sources, Regional Boards will give high priority to areas tributary to ASBS.

The Ocean Plan, and hence the designation of areas of special biological significance, is not applicable to vessel wastes, the control of dredging, or the disposal of dredging spoil.

The staff will advise other agencies to whom the list of designated areas is to be provided that the basis for this action by the Board is limited to considerations related to protection of marine life from waste discharges.

The following areas have been designated Areas of Special Biological Significance in the Central Coastal Basin:

1. Ano Nuevo Point and Island, San Mateo County

2. Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life Refuge, Monterey County

3. Point Lobos Ecological Reserve, Monterey County

4. Julia Pfeiffer Burns Underwater Park, Monterey County

5. Ocean area surrounding the mouth of Salmon Creek, Monterey County

6. Channel Islands, Santa Barbara County - San Miguel, Santa Rosa, Santa Cruz

Saline Water Habitat (SAL) - Provides an inland saline water habitat for aquatic life resources. Soda Lake is a saline habitat typical of desert lakes in inland sinks.

Wildlife Habitat (WILD) - Provides a water supply and vegetative habitat for the maintenance of wildlife.

Preservation of Rare and Endangered Species (RARE) - Provides an aquatic habitat necessary, at least in part, for the survival of certain species.

Marine Habitat (MAR) - Provides for the preservation of the marine ecosystem including the propogation and sustenance of fish, shellfish, marine mammals, waterfowl and vegetation such as kelp.

Fish Migration (MIGR) - Provides a migration route and temporary aquatic environment for anadromous or other fish species.

Fish Spawning (SPWN) - Provides a high quality aquatic habitat especially suitable for fish spawning.

Shellfish Harvesting (SHELL) - The collection of shellfish such as clams, oysters, abalone, shrimp, crab and lobster for either commercial or sport purposes.

RECOMMENDED BENEFICIAL USES

It is believed that the list of beneficial uses in Tables 2-1 and 2-2 accurately reflect future demands on the water resources of the Basin and that water quality objectives based on those uses will adequately protect the quality of the Basin's waters for future generations.

SECTION 2. WATER QUALITY OBJECTIVES

Chapter 3 Historical Water Quality Objectives

CHAPTER 3. HISTORICAL WATER QUALITY OBJECTIVES

This chapter presents the water quality objectives established in 1967 for interstate waters and those contained in the Central Coastal Basin Interim Plan, updated in 1973. Water quality objectives were developed for the protection of present and future beneficial uses as determined at the time the 1967 standards and the Interim Plan were prepared. Chapter 1 presented the historical uses which provided the basis for the historical water quality objectives that appear in this chapter.

1967 WATER QUALITY CONTROL POLICY

In 1967 the State of California established water quality standards for its interstate waters. The Central Coastal Basin was divided into three coastal areas—Rincon Point to Point Arguello, Point Arguello to Point Piedras Blancas and Point Piedras Blancas to Pescadero Point.

Point Arguello to Point Piedras Blancas and Point Piedras Blancas to Pescadero Point

Because of variations in beneficial water uses, the waters from Point Arguello to Pescadero Point have been divided into three zones: near shore waters, shell fishing areas and off shore waters.

Near shore water applies to estuaries and all waters in the ocean from the shoreline to a depth of 18 feet. These waters encompass the recreational beaches and clamming areas. Waste discharge which occurs in depths less than three fathoms (18 feet) will have greater direct effect upon the near shore waters than upon the open coastal waters.

Shell fishing areas within near shore waters are designated for the following specific locations:

I. Pismo Beach-between Santa Maria River and Shell Beach

2. Estero Bay-between Point Buchon and Point Estero

3. Morro Bay-south of the small boat launching ramp and along the south spit

4. Monterey Bay-Salinas River to Portero Road; and Moss Landing Harbor to Soquel Point

5. Elkhorn Slough.

Off shore waters applies to all coastal waters located between the near shore zone and the seaward boundary of the Region.

In addition, abalone, mussel, crab, and urchin fisheries are significant on rocky beaches throughout the coastal areas of the basin.

Near Shore Objectives.

Physical Standard. No sewage, sludge, grease, or other physical evidence of sewage or industrial wastes shall be visible at any time in the water or on the shore.

Coliform Bacteria. The MPN of coliform organisma shall be less then 1,000/100 ml (10/ml), provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000/100 ml (10/ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000/100 ml (100/ml). Bacterial analysis shall be made in accordance with procedures recommended by the current edition of Standard Methods for the Examination of Water and Wastewater of the American Public Health Association. The combinations of portions planted on lactose broth as a presumptive media shall be at least two (2) 1.0 ml portions, two (2) 0.1 ml portions, and two (2) 0.01 ml portions. All portions showing gas within 48 hours shall be confirmed on brilliant green bile broth.

For waters in vicinity of public and private piers, which are used for processing of whole or cut fish, the following objectives shall apply: The MPN of coliform organisms shall be less than 700/100 ml, provided that not more than 20 percent of the samples may exceed 700/100 ml when processing of whole fish is involved, and provided that not more than 5 percent of the samples may exceed 700/100 ml, when processing of cut fish is involved. Method of analysis to be as set forth above.

Turbidity. No turbidity of other than natural origin that will interfere with marine life, including fish, plant and bird life and the organisms upon which they depend, or will cause substantial visual contrast with natural appearance of the water.

Suspended Material. No suspended material of other than natural origin that will interfere with marine life, including fish, plant and bird life and the organisms upon which they depend, or will cause substantial visual contrast with natural appearance of the water.

Oil. No visible floating oil and grease of waste or petroleum product origin.

Bottom Deposits. Shall be free of materials that will: (1) adversely alter the composition of the bottom fauna; (2) interfere with the spawning of fish or deleteriously affect their habitat; and (3) adversely change the physical or chemical nature of the bottom.

pH. Within range 7.0 - 8.5.

Dissolved Oxygen. The dissolved oxygen concentration shall be greater than 5 mg/l.

Temperature. Changes by other than natural causes shall not cause undesirable ecological changes nor have deleterious effects upon aquatic plant and animal life.

Total Toxic Materials, including Heavy Metals. Shall not be present in concentrations that will be deleterious to aquatic life indigenous to the area.

Radionuclides. Shall not be present in concentraitons that will exceed the maximum permissible concentrations for radionuclides in water as set forth in Section 30269 of the California Administrative Code.

Shellfishing Objectives

All water quality criteria given for near shore waters are applicable to the near shore waters (shellfishing areas) except Item II, Coliform Bacteria, which shall be as follows:

The coliform median MPN of the water shall not exceed 70/100 ml, and not more than 10 percent of the samples ordinarily exceed an MPN of 230/100 ml for a 5-tube decimal dilution test (or 330/100 ml, where the 3-tube decimal dilution test is used) in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

Off Shore Objectives

All water quality criteria given for near shore waters are applicable to the off shore waters' zone, except Item II, Coliform Bacteria, which is deleted.

Rincon Point to Point Arguello

Waters from Rincon Point to Point Arguello are divided into three zones including near shore waters, open waters and Inner Harbor waters.

Near shore water applies to all waters in the area from the shore line out to a depth of ten fathoms. This area encompasses the recreational beaches, water skiing areas and essentially all of the kelp beds lying off shore from Santa Barbara County. Waste discharges which occur in depths less than ten fathoms will have a greater direct effect on the near shore waters than on the open waters of the Santa Barbara Channel.

Open water applies to all waters in the Santa Barbara Channel having a depth of ten fathoms or more. This area is used for all beneficial uses noted in Chapter 1 except those involving water contact activities. This area of water contains only a very small portion of the kelp beds which are of great importance to the vicinity.

Inner harbor waters apply to the Santa Barbara Yacht Harbor and will apply to other such mooring basins which may ultimately be constructed. Such inner harbors are not considered suitable for water contact activities. Furthermore, configuration of the harbor may result in water quality alterations because of complex influences from on-shore and harbor activities and restrictions to tidal exchanges, reaeration, etc. Therefore, water may not be of the same high quality in the inner harbors as in the near shore waters, regardless of care taken to preclude the influence of waste discharges upon the harbors. Planning of new harbors must consider such factors in order to maintain and enhance water quality for recognized beneficial uses.

Near Shore Objectives

Water quality objectives for near shore waters are the same as those described for Point Arguello to Pescadero Point, except for coliform bacteria and dissolved oxygen. The objectives for these are as follows:

Coliform Bacteria. Water quality shall conform to Bacteriological Standards set forth in Section 7958, California Administrative Code, except that samples during storm periods will not be included. Bacterial concentrations may be affected by causes other than waste discharges. This factor will be taken into consideration when specific cases are reviewed. Water in vicinity of commercial fish unloading and processing stations shall conform to the California State Department of Public Health Standards for the Processing of Whole Fish.

Dissolved Oxygen. Annual Average . . . not less than 90% saturation. Single Value . . . not less than 60% saturation.

Open Water Objectives

All water quality criteria given for the near shore waters are applicable to open waters, except Coliform Bacteria, which is deleted.

Inner Harbor Objectives

All water quality criteria given for near shore waters are applicable to the inner harbor area, except dissolved oxygen which is as follows:

Annual Average . . not less than 80% saturation
Single Value . . not less than 50% saturation

Waters throughout the Basin are subject to various beneficial uses. Water quality criteria for the coastal waters must be generally high in order to protect such uses. Criteria stated above indicate a level of quality consistent with that which is necessary for the fullest enjoyment of each group of beneficial uses.

Rationale For Water Quality Objectives

The rationale for these water quality factors is as follows:

Physical Standard. Physical standard relates to appearance and aesthetic considerations and nuisance factors which affect water uses.

Coliform Density. Coliform density has substantial public health significance. Because of the extensive use of water for water contact activities and for shellfish harvesting, Coliform Standards by the State Department of Health for ocean water contact sports areas, and the National Shellfish Sanitation Program Manual of Operation for Shellfishing Areas are applicable to areas of the region subject to such uses. Water Used in processing whole or cut fish is subject to "Bacteriological and Quality Standards for Water Used in Fish Canning Operations," as adopted by the State Department of Health.

Turbidity. Turbidity of the water affects activities in which adequate sight distance through the water is necessary. It is an important consideration for aesthetic reasons and normal sunlight penetration is essential to enhance desirable plant and animal life in the ocean.

Suspended Material. Suspended material may contribute to unsightly conditions and may interfere with water use such as water contact sports. The normal habitat is also affected by suspended material.

Oil. Oil in any quantity affects the marine environment, water contact sport uses, industrial uses, etc. Oil in large quantities is aesthetically objectionable.

Bottom Deposits. Bottom deposits may adversely affect the marine environment by interfering with normal plant and animal life. Such deposits may also render water contact sport areas unusable.

Dissolved Oxygen. Dissolved oxygen concentrations above the limit set will assure the maintenance of the normal marine environment. The presence of dissolved oxygen in the waters will minimize unsightliness and odor.

Temperature. Temperature has a direct effect upon the marine ecology. Control of temperature variations within reasonable limits is essential to assure the presence of a normal marine habitat and thus prevent undesirable ecological changes.

Total Toxic Materials, including Heavy Metals. Total toxic material, including heavy metals, refers essentially to potential waste discharges which may affect the marine environment. The objective is to maintain normal conditions in the ocean waters suitable for all desirable marine life to exist.

Radionuclides. Radionuclides in the waters may result from domestic and industrial waste discharge. Regualtion of such discharges to conform with the State Public Health Department regulations, as set forth in the California Administrative Code, is essential to protect human and marine life from hazardous exposure to uncontrolled radiation. Consideration must be given to natural background in the interpretation of this objective.

INTERIM PLAN

The objectives in the Interim Plan, which applies to all waters of the Basin, superseded the standards adopted in 1967 for interstate waters. There are a few differences between the objectives contained in the Interim Plan and the 1967 standards on coastal waters.

Specifically, objectives were added for color, odor, biostimulants and pesticides. The objective on turbidity was reworded to provide numerical limits and the objective on temperature was reworded to reflect adopted State policy regarding the control of temperature in Interstate waters, enclosed bays and estuaries.

Water Quality Objectives

The following water quality objectives are proportionate to the beneficial uses. For discussion purposes they are divided into levels of comparable quality.

Recreation

The following objectives will maintain waters suitable for aesthetic enjoyment, boating, including shipping and navigation, and general recreation.

Color. The apparent color caused by materials of waste origin shall not be greater than 15 units or 10 percent above natural background color, whichever is greater.

Turbidity. Waters shall be maintained at turbidity levels below that which may create unfavorable aesthetic conditions. Where natural turbidity is between 0-50 untis, increase shall not exceed 20 percent. No increase whall be greater than 10 units above natural background levels when natural turbidity is between 50 and 100 units or greater than 10 percent when above 100 units.

Odors. Waters shall be maintained free from odors of waste origin at all times.

Floatables, Oil and Grease. Waters shall be maintained free from floating solids, liquids, or foams of waste origin at all times.

Bottom Deposits. Waters shall be maintained free from bottom deposits or sludge banks of organic or inorganic waste origin at all times.

Biostimulants. Dissolved nutrients of waste origin shall be limited to additions below those which may cause undesirable algal, slime, bacteriological or other undesirable biological growths.

Dissolved Oxygen. Dissolved oxygen concentrations shall be maintained at or above an average of 5.0 mg/l. Groundwaters are excluded from this objective.

Swimming

Waters to be used for swimming must meet the following objectives in addition to those listed above.

Bacteria. As stipulated for fresh water by the California State Department of Public Health when such standards are available, and at no time during the interim, greater than those standards set for ocean water contact-sports area, or a maximum of 1,000 coliform organisms/100 milliliters.

Water Temperature. Temperature changes resulting from waste discharges shall comply with the State Water Resources Control Board "Policy Regarding the Control of Temperature in Coastal and Interstate Waters and Enclosed Bays and Estuaries of California."

pH. The pH shall not be depressed below 7.0 units or raised above 8.5 units as a result of waste discharges.

Toxicity. There shall be no organic or inorganic substances in concentrations which are toxic to human, animal, plant or aquatic life, or which create undesirable tastes or odors in the waters or in fish, wildlife or agricultural stock.

Radioactivity. Radionuclides shall not be present in concentrations that exceed the maximum permissible concentration for radionuclides in water as set forth in Chapter 5, Title 17, of the California Administrative Code.

Fish Habitat

Waters used as a fish habitat or for wildlife protection must meet the following objectives as well as all those listed above except for the bacteria objective.

Dissolved Oxygen. Dissolved oxygen concentrations shall be maintained at or above an average of 5.0 mg/l, except for those areas designated by the Department of Fish and Game as spawning and nursery areas, and cold water biota and trout habitat, or in the marine environment where the minimum dissolved oxygen shall be 7.0 mg/l.

Pesticides. The concentration of the total summation of individual pesticides shall not be greater than 0.1 microgram per liter, nor shall concentrations of pesticides be allowed that are detrimental to fish and wildlife.

Agriculture and Industrial

Water used for agricultural and industrial water supply or groundwater recharge must meet all of the objectives outlined for fish habitat and wildlife protection with the following changes and additions:

Dissolved Oxygen. Dissolved oxygen concentrations shall be maintained at or above an average of 1.0 mg/l. Groundwaters are excluded from this objective.

Chemical Quality. Waters shall not exceed the qualitative classification corresponding to that water, as shown in Table 3-1, and in no case shall a specific chemical constituent exceed 10 percent of the quality naturally occurring, as measured from a statistically meaningful historic baseline for each monitoring station or well, except where specific objectives are enumerated as in Table 3-1.

Municipal and Domestic Water Supplies

Water used for municipal and domestic water supplies shall meet all of the objectives established for agricultural, industrial and groundwater recharge and the following treatment shall be consistent with the criteria promulgated by the United States Public Health Service and/or standards adopted by the California State Department of Health as shown in Table 3-2.

Specific Objectives

In addition to the water quality objectives mentioned above, specific objectives for certain chemical constituent concentrations have been established for the waters of San Lorenzo Sub-basin, the Upper Salinas River Sub-basin, and certain streams in the Salinas River Sub-basin. These chemical concentration objectives are presented in Tables 3-3, 3-4, and 3-5.

INTERIM PLAN REVISIONS

Certain revisions and additions were made to the Interim Plan in 1973 relative to water quality objectives. For inland waters, objectives for municipal and domestic water supplies were expanded and the chemical objectives for the San Lorenzo River Sub-basin were made more stringent.

Inland Waters

Table 3-6 presents the objectives for municipal and domestic water supplies as adopted by the Regional Board on December 8, 1972. The hardness and sulfate objectives for the San Lorenzo River Sub-basin were reported to be 160 mg/l average concentration and 300 mg/l maximum concentration and 60 mg/l average and 110 mg/l maximum, respectively. The revised and more stringent objectives for these constituents are 60 mg/l average and 110 mg/l maximum for hardness and 40 mg/l average and 80 mg/l maximum for sulfate.

Ocean Waters

The State's Water Quality Control Plan for Ocean Waters of California and the State's Water Quality Control Plan for Control of Temperature in Coastal and Interstate Waters and Enclosed Bays and Estuaries of California are included in the revision to the Interim Plan. Following are the objectives for ocean waters in the Central Coastal Basin as specified in the two above State policies.[1]

Ocean waters are waters of the Pacific Ocean outside of enclosed bays, estuaries, and coastal lagoons. The discharge of waste shall not cause violation of these objectives.

Bacteriological Characteristics

1. Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas[2] outside this zone used for body-contact sports, the following bacteriological objectives shall be maintained throughout the water column:

Table 3-1. Water Quality Objectives for Qualitative Classification of Irrigation Water[a]

Chemical properties	Class 1 Excellent to good	Class 2 Good to injurious	Class 3 Injurious to unsatisfactory
Total dissolved solids, mg/l	Less than 700	700 - 2,000	More than 2,000
Conductance, micromhos at 25° C	Less than 1,000	1,000 - 3,000	More than 3,000
Chlorides, mg/l	Less than 175	175 - 350	More than 350
Sodium, percent of base constituents	Less than 60	60 - 75	More than 75
Boron, mg/l	Less than 0.5	0.5 - 2.0	More than 2.0

Class 1 - Regarded as safe and suitable for most plants under most conditions of soil and climate.

Class 2 - Regarded as possibly harmful for certain crops under certain conditions of soil or climate, particularly in the higher ranges of this class.

Class 3 - Regarded as probably harmful to most crops and unsatisfactory for all but the most tolerant.

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

Table 3-2. Water Quality Objectives for Municipal and Domestic Water Supplies

Characteristic	Recommended limit[a]	Short-Term limit[a]	Mandatory limit[a]
Physical			
Turbidity, units	5		-
Color, units	15		-
Threshold odor number	3		-
Chemical			
U.S. Public Health Service			
Alkyl benzene sulfonate (detergent) methylene blue active substance (MBAS) as ABS	0.5		-
Arsenic (AS)	0.01		0.05
Barium	-		1.0
Cadmium (Cd)	-		0.01
Carbon chloroform extract	0.2		-
Chloride (Cl)	250		-
Hexavalent chromium (Cr^{+6})	-		0.05
Copper (Cu)	1.0		-
Cyanide (Cn)	0.01		0.2
Fluoride (F)	-		-
Iron (Fe)	0.3		-
Lead (Pb)	-		0.05
Manganese (Mn)	0.05		-
Nitrate (NO_3)	45		-
Phenols	0.001		-
Selentum (Se)	-		0.01
Silver (Ag)	-		0.05
Sulfate (SO_4)	250		-
Total dissolved solids (TDS)	500		-
Zinc (Zn)	5		-
State Department of Health[b]			
Inorganic Chemicals			
Total Dissolved Solids	500	1,500	1,000
or			
Specific Conductance	800 micromhos	2,400 micromhos	1,600 micromhos
Chloride	250	600	500
Sulfate	250	600	500
Copper	1.0		
Iron	0.3		
Manganese	0.05		
Zinc	5.0		
Arsenic	0.10		
Barium	1.0		
Cadmium	0.01		
Chromium	0.05		
Cyanide	0.2		
Lead	0.05		
Mercury	0.005		
Nitrate-N + Nitrite-N	10		
Selenium	0.01		

[a] mg/l unless otherwise noted

[b] Recommended limit permit; short-term limit listed as temporary permit; mandatory limit listed as upper limit

Table 3-2. Water Quality Objectives for Municipal and Domestic Water Supplies (contd) [a]

Characteristic	Limiting Concentration		
	Lower	Optimum	Upper
Fluoride [b]			
50 - 54	0.9	1.2	1.7
55 - 58	0.8	1.1	1.5
59 - 64	0.8	1.0	1.3
65 - 71	0.7	0.9	1.2
72 - 79	0.7	0.9	1.2
80 - 81	0.6	0.7	0.8
Organic Chemicals			
Carbon-alcohol extract (CAE-m)			3.0
Carbon-chloroform extract (CCE-m)			0.7
Foaming agent (MBAS)			0.5
Pesticides:			
Aldrin			0.017
Chlordane			0.003
DDT			0.042
Dieldrin			0.017
Endrin			0.001
Heptachlor			0.018
Heptachlor Epoxide			0.018
Lindane			0.056
Methoxychlor			1.0
Organophosphorous and Carbamate compounds			0.1 [c]
Toxaphene			0.005
Herbicides:			
2,4-D plus			
2,4,5-T plus			
2,4,5-TP			0.1
Radioactivity			
Gross Beta			1,000 pc/l [d]
Radium-226			3 pc/l
Strontium-90			10 pc/l

[a] mg/l unless otherwise noted

[b] Annual Average of Maximum Daily Air Temperatures based on temperature date obtained for a minimum of five years.

[c] As parathion in cholinesterase inhibition

[d] Limiting activity level

Table 3-3. Water Quality Objectives for San Lorenzo River Sub-Basin[a]

Constituent	Concentration, mg/l	
	Average	Maximum
Total dissolved solids	300	600
Calcium	40	60
Magnesium	8	15
Hardness	60	110
Sulfate	40	80
Chloride	40	80
Fluoride	0.3	0.6
Boron	0.2	0.5
Detergents	0	0.1
Specific conductance, micromhos	500	1,000

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

Table 3-4. Water Quality Objectives for Upper Salinas River Sub-Basin[a]

Constituent, mg/l	Surface water[b]	Surface and groundwater[c]	Groundwater[d]
Total dissolved solids	1,000	500	500
Calcium	80	50	50
Magnesium	60	50	50
Sodium	150	100	100
Potassium	10	5	5
Sulfate	250	150	80
Chloride	150	80	80
Nitrate	10	5	15
Fluoride	0.7	0.5	0.5
Boron	0.8	0.5	0.5
Detergents	0.5	0.5	0.5
Specific conductance, micromhos	1,400	700	700

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

[b] In Cholame, San Juan, and San Marcos creeks and Estrella River.

[c] Surface water and groundwater in alluvium other than mentioned in Footnote b.

[d] In terrace deposits and Paso Robles formation.

Table 3-5. Water Quality Objectives for Surface Waters in the Salinas River Sub-Basin[a]

	Specific conductance, micromhos		Boron, mg/l	Percent sodium	
	Maximum monthly	Average annual		Maximum monthly	Average annual
Nacimineto River	400	300	0.5	30	20
San Antonio River	600	500	0.5	30	20
Arroyo Seco	500	300	0.5	30	20
Salinas River near Bradley	700	500	0.5	35	25
San Lorenzo Creek	3,000	2,000	1.5	60	50
Pancho Rico Creek	4,000	1,500	2.0	50	40
Chalone Creek	900	600	0.5	50	40
Chualar Creek	500	300	0.5	30	20
Quail Creek	600	400	0.5	40	30
Natividad Creek	700	600	0.5	40	30
Gabilan Creek	600	500	0.5	30	20

[a] State Water Resources Control Board, Interim Water Quality Control Plan: Central Coastal Basin, June, 1971.

Table 3-6. Regional Board Water Quality Objectives for Municipal and Domestic Water Supplies

Characteristics	Recommended limit[a]	Upper limit[a]	Short-term limit[a]
Total dissolved solids	500	1,000	1,500
Specific conductance, micromhos	800	1,600	2,400
Chloride	250	500	600
Sulfate	250	500	600
Color, units	15		
Copper	1.0		
Iron	0.3		
Manganese	0.05		
Odor, threshold number	3		
Zinc	5.0		
Arsenic	0.10		
Barium	1.0		
Cadmium	0.01		
Chromium	0.05		
Cyanide	0.2		
Lead	0.05		
Mercury	0.005		
Nitrate-N + Nitrite-N	10		
Selenium	0.01		
Carbon-alcohol extract (CAE-m)		3.0	
Carbon-chloroform extract (CCE-m)		0.7	
Foaming agent (MBAS)		0.5	
Pesticides			
Aldrin		0.017	
Chlordane		0.003	
DDT		0.042	
Dieldrin		0.017	
Endrin		0.001	
Heptachlor		0.018	
Heptachlor epoxide		0.018	
Lindane		0.056	
Methoxychlor		1.0	
Organophosphorous and carbamate compounds		0.1[b]	
Toxaphene		0.005	
Herbicides			
2,4-D plus 2,4,5-T plus 2,4,5-TP		0.1	
Fluoride	Optimum limit	Upper limit	Lower limit
50 - 54° F	1.2	1.7	0.9
55 - 58° F	1.1	1.5	0.8
59 - 64° F	1.0	1.3	0.8
65 - 71° F	0.9	1.2	0.7
72 - 79° F	0.9	1.2	0.7
80 - 81° F	0.7	0.8	0.6

[a] Mg/l except as noted; radioactivity values same as Table 3-2.

[b] As parathion in cholinesterase inhibition.

Samples of water from each sampling station shall have a most probable number of coliform organisms less than 1,000/100 ml (10/ml); provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000/100 ml (10/ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000/100 ml (100/ml).

The fecal coliform content shall not exceed a log mean most probable number (MPN) of organisms of 200/100 ml nor shall the fecal coliform content of more than 10% of the total samples during any 30 day period exceed a MPN of 400/100 ml. Fecal coliform shall be determined by multiple tube fermentation procedures based on at least five samples for any 30 day period.

2. At all areas[2] where shellfish may be harvested for human consumption, the following bacteriological objectives shall be maintained throughout the water column:

The median total coliform concentration shall not exceed 70/100 ml, and not more than 10 percent of the samples shall exceed 230/100 ml.

Physical Characteristics

1. Floating particulates and grease and oil shall not be visible.

2. The concentrations of grease and oil (hexane extractables) on the water surface shall not exceed 10 mg/m^2 more than 50 percent of the time, nor 20 mg/m^2 more than 10 percent of the time.[3]

3. The concentration of floating particulates of waste origin on the water surface shall not exceed 1.0 mg dry weight/m^2 more than 50 percent of the time, nor 1.5 mg dry weight/m^2 more than 10 percent of the time.[3]

4. The discharge of waste shall not cause aesthetically undesirable discoloration of the ocean surface.

5. The transmittance of natural light shall not be significantly[4] reduced at any point outside the initial dilution zone.[5]

6. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.[6]

Chemical Characteristics

1. The dissolved oxygen concentration[7] shall not at any time be depressed more than 10 percent from that which occurs naturally.

2. The pH[7] shall not be changed at any time more than 0.2 units from that which occurs naturally.

3. The dissolved sulfide concentration of waters in and immediately above sediments shall not be significantly[4] increased above that present under natural conditions.

4. The concentration of (certain specified toxic or hazardous) substances in marine sediments shall not be significantly[4] increased above that present under natural conditions.

5. The concentration of organic materials in marine sediments shall not be increased above that which would degrade[6] marine life.

6. Nutrient materials shall not cause objectionable aquatic growths or degrade[6] indigenous biota.

Biological Characteristics

1. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.[6]

2. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.

Toxicity Characteristics

1. The final toxicity concentration shall not exceed 0.05 toxicity units.[8]

Radioactivity

1. Radioactivity shall not exceed the limits specified in Section 30269 of the California Administrative Code.

Temperature

Elevated temperature and thermal waste discharges to the ocean shall not violate the following objectives:

1. Existing elevated temperature waste discharges shall comply with limitations necessary to assure protection of the beneficial uses and areas of special biological significance.

2. New elevated temperature wastes shall be discharged to the open ocean away from the shoreline to achieve dispersion through the vertical water column.

3. New elevated temperature wastes shall be discharged a sufficient distance from areas of special biological significance to assure the maintenance of natural temperature in these areas.

4. The maximum temperature of new thermal waste discharges shall not exceed the natural temperature of receiving waters by more than 20°F.

5. Any new discharge of elevated temperature wastes shall not result in increases in the natural water temperature exceeding 4°F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

Footnotes for Section on Ocean Waters

[1] The Water Quality Objectives and Effluent Quality Requirements are defined by a statistical distribution when appropriate. This method recognizes the normally occurring variations in treatment efficiency and sampling and analytical techniques and does not condone poor operating practices. The 50 percentile value (concentration not to be exceeded more than 50 percent of the time) and 90 percentile value (concentration not to be exceeded more than 10 percent of the time) establish an acceptable distribution for any consecutive 30-day period. The distribution of actual sampling data for any consecutive 30-day period shall not have any percentile value exceeding that of the acceptable distribution.

[2] Body-contact sports areas outside the shoreline zone and all shellfishing areas shall be determined by the Regional Board on an individual basis.

[3] Surface samples shall be collected from stations representative of the area of maximum probable impact.

[4] The mean of sampling results for any consecutive 30-day period must be within one (1) standard deviation of the mean determined for natural levels for the same period.

[5] Initial Dilution Zone is the volume of water near the point of discharge within which the waste immediately mixes with ocean water due to the momentum of the waste discharge and the difference in density between the waste and the receiving water.

[6] Degradation shall be determined by analysis of the effects of waste discharge oon species diversity, population density, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species.

[7] Compliance with water quality objectives shall be determined from samples collected at stations representative of the area within the waste field where initial dilution is completed. The 10 percent depression of dissolved oxygen may be determined after allowance for effects of induced upwelling.

[8] This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

a. Toxicity Concentration (Tc)

Expressed in Toxicity Units (tu)

$$\text{Tc (tu)} = \frac{100}{\text{96-hr. TLm\%}}$$

b. Median Tolerance Limit (TLm%)

The TLm shall be determined by static or continuous flow bioassay techniques using standard test species. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, the TLm may be determined after the test samples are adjusted to remove the influence of those substances.

When it is not possible to measure the 96-hour TLm due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

$$\text{Tc (tu)} = \frac{\log(100 - S)}{1.7}$$

S = percentage survival in 100% waste

c. Toxicity Emission Rate (TER)

Is the product of the effluent Toxicity Concentration (TC) and the waste flow rate expressed as mgd.

$$TER\ (tu \cdot mgd) = Tc\ (tu) \times \text{Waste Flow Rate (mgd)}$$

d. Final Toxicity Concentration

(FTc) expressed in toxicity units (tu) shall be determined by a bioassay and estimated by the following calculations:

$$FTc\ (tu) = \frac{\text{Toxicity Emission Rate}}{\text{Initial Dilution Water + Waste Flow}}$$

$$= \frac{TER}{Qd + Qw}$$

e. Initial Dilution Water (Qd)

Shall be calculated as the product of estimated current velocity, effective diffuser length normal to the prevailing current, and effective mixing depth.

Enclosed Bays

Enclosed bays are defined as indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outmost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes Morro Bay.

Objectives

The following objectives will maintain tidal waters in enclosed bays suitable for beneficial uses and prevent nuisance:

Color. The apparent color caused by materials of waste origin shall not be greater than 15 units or 10 percent above natural background color, whichever is greater.

Turibidity. Waters shall be maintained at turbidity levels below that which may create unfavorable aesthetic conditions. Where natural turbidity is between 0-50 units, increase shall not exceed 20 percent. No increase shall be greater than 10 units above natural background levels when natural turbidity is between 50 and 100 units or greater than 10 percent when above 100 units.

Odors. Waters shall be maintained free from odors of waste origin at all times.

Floatables, Oil and Grease. Waters shall be maintained free from floating solids, liquids, or foams of waste origin at all times.

Bottom Deposits. Waters shall be maintained free from bottom deposits or sludge banks of organic or inorganic waste origin at all times.

Biostimulants. Dissolved nutrients of waste origin shall be limited to additions below those which may cause undesirable algal, slime, bacteriological or other undesirable biological growths.

Bacteria. Same objectives as those specified for ocean waters.

pH. The pH shall not be depressed below 7.0 units nor raised above 8.5 units as a result of waste discharges.

Toxicity. There shall be no organic or inorganic substances in concentrations which are toxic to human, animal, plant or aquatic life, or which create undesirable tastes or odors in the waters or in fish, wildlife or agricultural stock.

Radioactivity. Radionuclides shall not be present in concentrations that exceed the maximum permissible concentration for radionuclides in water as set forth in Cahpter 5, Title 17, of the California Administrative Code.

Dissolved Oxygen. Dissolved oxygen concentrations shall be maintained at or above an average of 5.0 mg/l, except for those areas designated by the Department of Fish & Game as spawning and nursery areas, and cold water biota and trout habitat, or in the marine environment where the minimum dissolved oxygen shall be 7.0 mg/l.

Perticides. The concentration of the total summation of individual pesticides shall not be greater than 0.1 microgram per liter, nor shall concentrations of pesticides be allowed that are detrimental to fish and wildlife. Pesticides are defined as any substance or combination of substances used to control objectionable insects, weeds, rodents, fungi, or other forms of plant or animal life.

Temperature. Elevated temperature and thermal waste discharges to enclosed bays shall not violate the following objectives:

1. Existing elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses.

2. New elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses. The maximum temperature of waste discharges shall not exceed the natural temperature of the receiving waters by more than 20°F.

Estuaries

Estuaries are defined as waters at the mouths of streams which serve as mixing zones for fresh and ocean water during a major portion of the year. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters.

Objectives

Water quality objectives for estuaries are identical to those presented above for enclosed bays except for temperatures. The following temperature objectives shall apply to estuaries in the Central Coastal Basin.

Temperature. Elevated temperature and thermal waste discharges shall comply with the following:

1. Existing elevated temperature discharges shall not exceed the natural temperature of receiving waters by more than 20°F.

2. Existing elevated temperature waste discharges either individually or combined with other discharges shall not create a zone, defined by water temperatures of more than 1°F above natural receiving water temperature, which exceeds 25 percent of the cross-sectional area of a main river channel at any point.

3. No existing discharge shall cause a surface water temperature rise greater than 4°F above the natural temperature of the receiving waters at any time or place.

4. Existing thermal waste discharges shall comply with Provisions 1, 2, and 3 above, and in addition, the maximum temperature of existing thermal waste discharges shall not exceed 86°F.

5. New elevated temperature waste discharges shall comply with 1, 2, and 3 above.

Exceptions to specific temperature water quality objectives contained in this plan may be authorized by the Regional Board for a specific discharge upon a finding following public hearing that:

1. An elevated temperature waste discharge in compliance with modified objectives will result in the enhancement of beneficial uses as compared to predischarge conditions, or

2. The use of heat on an intermittent basis to control fouling organisms in intake and discharge structures will result in less potential for deleterious effects upon beneficial uses than other alternative methods (heat, in addition to that required for cleaning of intake and discharge structures, shall not be used for cleaning of condenser units), or

3. Changes in existing discharge structures or their operation to obtain compliance with water quality objectives would result in an environmental impact greater than would occur with modified water quality objectives, or

4. Compliance by existing dischargers with specific water quality objectives would require modification of operations or facilities not commensurate with benefit to the aquatic environment.

Such findings must be approved by the State Water Resources Control Board and the Federal Environmental Protection Agency before they can become effective.

Chapter 4 Water Quality Objectives

INTRODUCTION

Section 13241, Division 7 of the California Water Code specifies that each Regional Water Quality Control Board shall establish water quality objectives which, in the Regional Board's judgment, are necessary for the reasonable protection of beneficial uses and for the prevention of nuisance.

Section 303 of the 1972 Amendments to the Federal Water Pollution Control Act requires the State to submit to the Administrator of the U.S. Environmental Protection Agency for his approval, all new or revised water quality standards which are established for surface and ocean waters. Under federal terminology, water quality standards consist of the beneficial uses enumerated in Chapter 2 and the water quality objectives contained in this chapter.

The water quality objectives contained herein are designed to satisfy all state and federal requirements.

As new information becomes available, the Regional Board will review the appropriateness of the objectives contained herein. These objectives will be subject to public hearing at least once during each three year period following adoption of this plan for the purpose of review and modification as appropriate.

CONSIDERATIONS IN SELECTING WATER QUALITY OBJECTIVES

The aforementioned 1972 Amendments to the Federal Water Pollution Control Act declare that the national goal is elimination of discharge of pollutants into navigable waters by 1985. The interim goal is to achieve, by July 1983, water quality that provides for the protection of fish, shellfish, and wildlife and safeguards recreation uses in and on the water.

A prerequisite to water quality control planning is the establishment of a control base or reference point. The control base in this instance was various general and specific water quality criteria previously found acceptable for particular beneficial uses or selected sources of waste. Current technical guidelines, available historical data, and enforcement feasibility were given full consideration in formulating water quality objectives.

A distinction is made here among the terms water quality planning criteria, water quality objectives, and water quality standards. Water quality planning criteria are conditions, which may include numerical values, that pertain to qualities of water. They were recommended for use in developing plans to control water quality, but were not necessarily recommended for adoption as water quality objectives or standards. Water quality objectives differ from water quality planning criteria in that they have been adopted by the state and, when applicable, extended as federal water quality standards. Water quality standards, previously mentioned in this chapter's introduction, pertain to navigable waters and become legally enforceable criteria when accepted by the EPA Regional Administrator having jurisdiction over the body of water to which the standards are referred.

Water pollution causes described herein are broadly defined as point and non-point sources and have the same meaning as defined in the Federal Water Pollution Control Act. Point sources are waste loads from identifiable sources such as municipal discharges, industrial discharges, vessels, controllable stormwaters, fish hatchery discharges, confined animal operations, and agricultural drains. Non-point sources are waste loads resulting from land use practices where wastes are not collected and disposed of in any readily identifiable manner. Examples include: urban drainage; agricultural runoff; road construction activities; mining; grassland management; logging and other harvest activities; and natural sources such as effects of fire, flood, and landslide. The distinction between point sources and diffuse sources is not always clear but generally applies to the practicality of waste load control.

For planning purposes there are three basic long-term strategies for water pollution control. These are to be applied to specific geographic areas or to be compared in terms of their relative impact on an area of designated use, whichever is deemed appropriate. The strategies are defined as follows:

1. Elimination of all waste discharges from both point sources and diffuse sources,
2. Elimination of direct point source waste discharges and regulation of diffuse sources,
3. Elimination of discharge of pollutants into navigable waters.

Strategy number one, in effect, restricts land use and is consistent with policies to protect wilderness areas, selected water supply catchments, and some areas of special biological significance. Strategy two is consistent with maintenance of certain wild rivers and protection of sensitive aquatic habitats where no allocation of stream assimilation capacity can be provided for controllable discharges unless water reclamation concepts are applied. Strategy three is consistent with the long-term national goals of the Federal Water Pollution Control Act with the understanding that pollutants will be defined in relevant terms and that best practicable treatment would be consistently applied on a case-by-case basis depending on the physical character of the receiving water and the beneficial uses to be protected.

Water quality objectives for the Central Coastal Basin satisfy state and federal requirements to protect waters for the beneficial uses in Chapter 2 and are consistent with all existing statewide plans and policies. Water quality planning criteria for designated beneficial uses were recommended by committees established by the State Board. The State Board drew on these and other technical reference sources in developing a set of guidelines to be used in evaluating the quality of water required for various beneficial uses.

Existing Statewide Plans and Policies

The State Water Resources Control Board has adopted a "Statement of Policy with Respect to Maintaining High Quality of Waters in California", the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", the "Water Quality Control Plan for Ocean Waters of California", and the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California". The Regional Board is required to implement these plans and policies.

Nondegradation Policy

On October 28, 1968, the State Water Resources Control Board adopted Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California". While requiring continued maintenance of existing high quality waters, the policy provides conditions under which a change in water quality is allowable. A change must:

1. be consistent with maximum benefit to the people of the State,
2. no unreasonably affect present and anticipated beneficial uses of water, and
3. not result in water quality less than that prescribed in water quality control plans or policies.

Thermal Plan

The "Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California", adopted by the State Water Resources Control Board on May 18, 1972, specifies water quality objectives, effluent quality limits and discharge prohibitions related to thermal characteristics of enclosed bay and estuary waters and waste discharges.

Ocean Plan

The "Water Quality Control Plan for Ocean Waters of California", Resolution No. 72-45, was adopted by the State Water Resources Control Board on July 6, 1972. This plan establishes beneficial uses and water quality objectives for waters of the Pacific Ocean adjacent to the California Coast outside of enclosed bays, estuaries, and coastal lagoons. Also, the Ocean Plan prescribes effluent quality requirements and management principles for waste discharges and specifies certain waste discharge prohibitions.

The Ocean Plan also provides that the State Water Resources Control Board shall designate Areas of Special Biological Significance (ASBS) and requires wastes to be discharged a sufficient distance from these areas to assure maintenance of natural water quality conditions.

Bays and Estuaries Policy

The "Water Quality Control Policy for the Enclosed Bays and Estuaries of California", Resolution No. 74-43, adopted by the State Water Resources Control Board on May 16, 1974, provides water quality principles and guidelines to prevent water quality degradation and to protect the beneficial uses of waters. Decisions by the Regional Board are required to be consistent with the provisions of this policy. This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation and combined sewer flows. The policy includes Morro Bay and estuarine areas too numerous to list. High priority estuarine areas within the Central Coast include Pescadero Marsh, Elkhorn Slough, Morro

Bay, the Santa Ynez River mouth, Goleta Slough, and El Estero (Carpinteria Marsh).

WATER QUALITY OBJECTIVES

The water quality objectives which follow supersede and replace those contained in the 1967 Water Quality Control Policies; the Interim Water Quality Control Plan for the Central Coastal Basin adopted in 1971, including all existing revisions; and the Water Quality Control Plan Report for the Central Coastal Basin adopted in 1974.

Controllable water quality factors shall conform to the water quality objectives contained herein. When other factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, controllable factors shall not cause further degradation of water quality.

Controllable water quality factors are those actions, conditions, or circumstances resulting from man's activities that may influence the quality of the waters of the State and that may be reasonably controlled.

These water quality objectives are considered to be necessary to protect those present and probably future beneficial uses enumerated in Chapter 2 of this plan and to protect existing high quality waters of the State. These objectives will be achieved primarily through the establishment of waste discharge requirements and through the implementation of this water quality control plan.

The Regional Board in setting waste discharge requirements will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives. The Regional Board will make a finding as to the beneficial uses to be protected and establish waste discharge requirements to protect those uses and to meet water quality objectives.

General Objective

Water quality is generally good throughout the Central Coastal Basin, although groundwaters are highly mineralized in some areas. Tables 4-1 and 4-2 compare available data representative of water quality in several streams and groundwater basins to selected water quality planning criteria excerpted from historical sources referenced in Chapter 3. Parameters listed are limited to mineral constituents for which data are available: dissolved oxygen and pH are variable with seasonal and diurnal influences and thus are not listed in either table. Other parameters such as heavy metals and organic compounds are not tabulated because of insufficient data. Tables 4-1 and 4-2 indicate that existing mineral quality is generally better than the quality required for municipal and agricultural water supplies, as well as water contact recreational activities and fresh water habitat. Nitrogen concentrations are typically lower in the upper reaches of streams. Therefore, suggested nitrogen maxima should recognize the existence of nutrient gradations in natural streams. Consequently, the following objective shall apply to all waters of the basin.

Nondegradation Policy

Wherever the existing quality of water is better than the quality of water established herein as objectives, such existing quality shall be maintained unless otherwise provided by the provisions of the State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California", including any revisions thereto. A copy of this policy is included verbatim in the "Plans and Policies Appendix".

Objectives for Ocean Waters

The provisions of the State Board's "Water Quality Control Plan for Ocean Waters of California" (Ocean Plan), and "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" (Thermal Plan) and any revisions thereto shall apply in their entirety to the affected waters of the basin. The Ocean and Thermal Plans shall also apply in their entirety to Monterey Bay and Carmel Bay. Copies of these plans are included verbatim in the "Plans and Policies Appendix".

In addition to the provisions of the Ocean Plan and Thermal Plan, the following objectives shall also apply to all ocean waters, including Monterey and Carmel Bays:

Dissolved Oxygen

The mean annual dissolved oxygen concentration shall not be less than 7.0 mg/l, nor shall the minimum dissolved oxygen concentration be reduced below 5.0 mg/l at any time.

Table 4-1. Selected Comparisons of Existing Surface Water Quality with Water Quality Planning Criteria, mg/l

Sub-basin/subarea	TDS	Cl	SO_4	B	NA	N[c]
Planning Criteria [a]						
MUN [b]	500/1500	250/600	250/500		-	10
AGR [d]	700/2000	175/350		0.5/2.0	69[e]	-
REC-2					-	2.0
COLD					-	1.0
Existing Water Quality [f]						
Santa Ynez						
Cachuma Reservoir	545	16	218	.36	38	0.2
Solvang	716	38	252	.33	53	0.4
Lompoc	1055	97	355	.37	86	0
Santa Maria						
Cuyama Riv. (nr. Garay)	923	49	416	.24	77	0.4
Sisquoc River (nr. Garay)	580	17	228	.13	39	0.5
Soda Lake	221,000	60,600	79,200	42	-	-
San Luis Obispo						
Santa Rosa Creek	458	25	83	.21	-	0.5
Chorro Creek	433	43	31	.05	-	0.9
San Luis Obispo Creek	622	94	87	.19	-	3.2
Arroyo Grande Creek	805	32	159	.06	-	0.7
Salinas River						
Salinas River						
Above Bradley	216	13	99	0.10	16	0.2
Above Spreckles	600	80	64	0.20	74	2.9
Gabilan Tributary	258	37	30	.09	28	1.1
Diablo Tributary	1220	75	690	.65	170	-
Nacimiento River	160	6	29	0	9	.2
San Antonio River	230	13	59	0	20	.2
Carmel River	150	13	29	0	14	0.1
Monterey Coastal						
Big Sur River	170	6	17	-	8	0.1
Pajaro River						
at Chittenden	1100	260	210	1.2	255	0.5
San Benito River	1400	192	356	1.8	260	0.1
Llagas Creek	152	5	18	0.07	8	0.2
San Lorenzo River						
Boulder Creek	137	9.6	9.0	.04	11	0.2
Zayante Creek	430	30	109	.13	36	0.1
San Lorenzo River						
Above Bear Creek	395	69	81	.21	53	0.2
at Check Dam	240	51	59	.06	23	0.1

[a] Values are limiting concentrations; where two values appear (e.g., a/b), the first is the threshold value, the second is the short-term limit value.

[b] MUM criteria based on values promulgated by California State Board of Public Health (Table 3-2).

[c] Existing data based on nitrate only. Criteria based on sum of nitrate and nitrite nitrogen. REC-2 and COLD are total nitrogen considered maxima for control of eutrophication. All expressed as Nitrogen.

[d] Most AGR criteria based on Department of Agriculture values (see Table 3-1).

[e] From foliar absorption (Table 4-5).

[f] Existing quality data compiled from Interim Plan and Regional Board and/or Department of Water Resources water quality reports.

Table 4-2. Selected Comparisons of Existing Groundwater Quality with Water Quality Planning Criteria, mg/l

	TDS	Cl	SO_4	B	Na	N [c]
Planning Criteria [a]						
MUN [b]	500/1500	250/600	250/500	-	-	10
AGR [d]	700/2000	175/350	-	0.5/2	69[e]	-
Existing Water Quality [f]						
Santa Ynez						
Santa Ynez	597	47	7	.21	20	0.4
Santa Rita	1089	136	718	.58	112	0.4
Lompoc	1755	345	481	.59	239	0.7
Santa Maria						
S.M. Valley (Garey)	809	58	321	.14	67	3.5
S.M. Valley (coastal)	1034	69	440	.18	86	2.2
Cuyama Valley	1634	70	-	0.4	-	1.4
San Antonio Creek	593	111	108	.12	86	3.3
Soda Lake	8300	1800	3100	2.7	-	12.5
Santa Barbara Coastal						
Goleta	940	140	280	0.20	121	2.3
Santa Barbara	670	50	140	0.12	75	1.1
Carpinteria	660	90	120	0.21	77	5.6
San Luis Obispo						
Santa Rosa	699	102	72	.12	-	2.0
Chorro	1022	254	104	.13	-	3.3
San Luis Obispo Creek	843	175	92	.23	-	3.9
Arroyo Grande	807	93	212	.11	-	10
Salinas River						
Upper Valley	582	122	113	0.3	58	3.2
Upper Forebay	790	84	281	-	100	1.6
Lower Forebay	2030	319	840	0.4	154	7.5
180 foot Aquifer	1414	243	624	0.6	255	0
400 foot Aquifer	400	27	102	0.19	41	0
Pajaro River						
Hollister	1210	116	262	1.0	170	1.7
Tres Pinos	940	125	240	1.6	140	1.0
Gilroy	296	14	40	.14	17	2.9
San Lorenzo River						
Near Felton	72	5.3	2.8	.05	7.7	0.4
Near Boulder Creek	242	23	34	0	19	2.2

[a] Values are limiting concentrations; where two values appear (e.g., a/b), the first is the threshold value, the second is the short-term limit value.

[b] MUN criteria based on values promulgated by California State Board of Public Health (Table 3-2).

[c] Existing data based on nitrate only. Criteria based on sum of nitrate and nitrite nitrogen. REC-2 and COLD are total nitrogen considered maxima for control of eutrophication. All expressed as Nitrogen.

[d] Most AGR criteria based on Department of Agriculture values (see Table 3-1).

e From foliar absorption (Table 4-5).

[f] Existing quality data compiled from Interim Plan and Regional Board and/or Department of Water Resources water quality reports.

pH

The pH value shall not be depressed below 7.0, nor raised above 8.5.

Objectives for Inland Surface Waters, Enclosed Bays and Estuaries

The following objectives apply to all inland surface waters, enclosed bays and estuaries of the basin;

Color

Waters shall be free of coloration that causes nuisance or adversely affects beneficial uses. Coloration attributable to materials of waste origin shall not be greater than 15 units or 10 percent above natural background color, whichever is greater.

Tastes and Odors

Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

Floating Material

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Suspended Material

Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Settleable Material

Waters shall not contain settleable material in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes, or other similar materials as in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Numerical objectives for nutrients are specified in Table 4-3.

Sediment

The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity

Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Increase in turbidity attributable to controllable water quality factors shall not exceed the following limits:

1. Where natural turbidity is between 0 and 50 JTU, increases shall not exceed 20 percent.

2. Where natural turbidity is between 50 and 100 JTU, increases shall not exceed 10 JTU.

3. Where natural turbidity is greater than 100 JTU, increases shall not exceed 10 percent.

Allowable zones of dilution within which higher concentrations will be tolerated will be defined for each discharge in discharge permits.

pH

The pH shall neither be depressed below 6.5 nor raised above 8.3 in waters with designated REC-1, REC-2, AGR, or MUN beneficial uses. For waters with designated aquatic habitat protection, including WARM, COLD, MAR, and BIOL, and for waters not otherwise mentioned, the pH shall not be depressed below 7.0 or raised above 8.5.

Changes in normal ambient pH levels shall not exceed 0.2 in waters with designated MAR beneficial uses, nor 0.5 in fresh waters with designated COLD or WARM beneficial uses.

Dissolved Oxygen

The dissolved oxygen concentration shall not be

Table 4-3. Water Quality Objectives for Biostimulants

Designated Water	Concentration Not to be Exceeded	
	Total Nitrogen mg/l	Total Phosphorus mg/l
MAR or WARM	2.0	0.2
COLD or SPWN	1.0	0.1
REC-1 or REC-2	0.5	0.05

Table 4-4. Inorganic, Organic and Fluoride Concentrations Not To Be Exceeded in Domestic or Municipal Supply

Constituent	Limiting Concentration mg/l		
	Lower	Optimum	Upper
Fluoride*			
50-54	0.9	1.2	1.7
55-58	0.8	1.1	1.5
59-64	0.8	1.0	1.3
65-71	0.7	0.9	1.2
72-79	0.7	0.8	1.0
80-81	0.6	0.7	0.8
Inorganic Chemicals			
Arsenic			0.10
Barium			1.0
Cadmium			0.01
Chromium			0.05
Cyanide			0.2
Lead			0.05
Mercury			0.005
Nitrate-N + Nitrite-N			10
Selenium			0.01
Organic Chemicals			
Carbon-alcohol extract (CAE-m)			3.0
Carbon-Chloroform extract (CCE-m)			0.7
Foaming agent (MBAS)			0.5

*Annual Average of Maximum Daily Air Temperature, °F Based on temperature data obtained for a minimum of five years.

reduced below the following minimum values at any time:

Water designated	Minimum DO, mg/l
AGR, excluding GWR	2.0
WARM	5.0
SPWN, MAR or COLD	7.0

For waters not listed above and where specific minimum values are not prescribed, the dissolved oxygen concentration shall not be reduced below 5.0 mg/l at any time. Median values should not fall below 85 percent saturation as a result of controllable water quality factors.

Bacteria

In waters designated for contact recreation (REC-1) the fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200/100 ml, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 ml.

In waters designated for noncontact recreation (REC-2) and not designated for contact recreation (REC-1), the average fecal coliform concentration for any 30-day period shall not exceed 2000/100 ml, nor shall more than ten percent of samples collected during any 30-day period exceed 4000/100 ml.

At all areas where shellfish may be harvested for human consumption (SHELL), the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Temperature

Temperature objectives for Enclosed Bays and Estuaries are as specified in the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" including any revisions thereto. A copy of this plan is included verbatim in the "Plans and Policies Appendix".

In addition, the following temperature objectives apply to surface waters: The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in temperature does not adversely affect beneficial uses.

At no time or place shall the temperature of any COLD or WARM intrastate waters be increased by more the 5°F above natural receiving water temperature.

Toxicity

All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in, human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration or other appropriate methods as specified by the Regional Board.

The survival of aquatic life in surface waters subjected to a waste discharge or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge or, when necessary, for other control water that is consistent with the requirements for "experimental water" as described in Standard Methods for the Examination of Water and Wastewater, latest edition. As a minimum, compliance with this objective as stated in the previous sentence shall be evaluated with a 96-hour bioassay.

In addition, effluent limits based upon acute bioassays of effluents will be prescribed where appropriate, additional numerical receiving water objectives for specific toxicants will be established as sufficient data become available, and source control of toxic substances will be encouraged.

The discharge of wastes shall not cause concentrations of unionized ammonia (NH_3) to exceed 0.025 mg/l (as N) in receiving waters.

Pesticides

No individual pesticide or combination of pesticides shall reach concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Administrative Code, Titie 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 4 and listed below:

Pesticides:	mg/l
Aldrin	.0.017
Chlordane	.0.003
DDT	.0.042
Dieldrin	.0.017
Endrin	.0.001
Heptachlor	.0.018
Heptachlor epoxide	.0.018
Lindane	.0.056
Methoxychlor	1.0
Organophosphorous & Carbamate compounds	0.1 As parathion in cholinesterase inhibition
Toxaphene	.0.005

Herbicides:

2, 4-D plus 2, 4, 5-T plus 2, 4, 5-TP	0.1

For waters where existing concentrations are presently nondetectable or where beneficial uses would be impaired by concentrations in excess of nondetectable levels, total identifiable chlorinated hydrocarbon pesticides shall not be present at concentrations detectable within the accuracy of analytical methods prescribed in Standard Methods for the Examination of Water and Wastewater, latest edition, or other equivalent methods approved by the Executive Officer.

Chemical Constituents

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Sub-chapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4 and listed in Table 4-4.

Waters of the Central Coastal Basin designated WARM, COLD, MAR, or SPWN shall not contain concentrations of chemical constituents known to be deleterious to fish or wildlife in excess of the limits listed in Table 4-5.

Waters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts which adversely affect such beneficial use. Interpretation of adverse effect shall be as derived from the University of California Agricultural Extension Service guidelines provided in Table 4-6. In addition, waters used for irrigation and livestock watering shall not exceed concentrations listed for those used in Table 4-7. Salt concentrations for irrigation waters shall be controlled through implementation of the nondegradation policy to the effect that mineral constituents of currently or potentially usable waters shall not be increased. It is emphasized that no controllable water quality factor shall degrade the quality of any groundwater resource or adversely affect long-term soil productivity.

Where wastewater effluents are returned to land for irrigation uses, regulatory controls shall be consistent with Title 17 of State Health Code and with relevant controls for local irrigation sources.

Other Organics

Waters designated MUN shall not contain concentrations of phenols in excess of 1.0 ug/l. Other Central Coastal waters shall not contain organic substances in concentrations greater than the following:

MBAS	0.2 mg/l
Phenols	0.1 mg/l
PCB's	0.3 μg/l
Phthalate Esters	0.002μg/l

Radioactivity

Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life; or result in the accumulation or radionuclides in the food web to an extent which presents a hazard to human, plant, animal or aquatic life.

Waters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Subchapter 1, Group 1, Article 4, Section 7019, Table 5, and listed below:

Radioactivity	
Gross Beta	1,000 pc/l
Radium-226	.3 pc/l
Strontium-90	10 pc/l

Table 4-5. Toxic Metal Concentrations not to be Exceeded[a] in Aquatic Life Habitats, mg/l

Metal	Freshwater (COLD, WARM)		Marine (MAR)
	Hard (>100 mg/l $CaCO_3$)	Soft (<100 mg/l $CaCO_3$)	
Cadmium[b]	0.03	.004	.0002
Chromium	.05	.05	.05[c]
Copper	.03	.01	.01
Lead	.03	.03	.01
Mercury[d]	.0002	.0002	.0001
Nickel[e]	.4	.1	.002
Zinc	.2	.004	.02

[a] Based on limiting values recommended in the National Academy of Sciences-National Academy of Engineers "Water Quality Criteria 1972". Values cited are 90 percentile values except as noted in qualifying note "d".

[b] Lower cadmium values not to be exceeded for crustaceans and waters designated SPWN are 0.003 mg/l in hard water and 0.0004 mg/l in soft water.

[c] The maximum permissible value for waters designated SHELL shall be 0.01 mg/l.

[d] Total mercury values should not exceed 0.05 ug/l as an average value; maximum acceptable concentration of total mercury in any aquatic organism is a total body burden of 0.5 ug/l wet weight.

[e] Value cited as objective pertains to nickel salts (not pure metalic nickel).

Table 4-6. Guidelines for Interpretation of Quality of Water for Irrigation[a]

Problem and related constituent	Water quality guidelines		
	No problem	Increasing problems	Severe
Salinity[b]			
EC of irrigation water, mmho/cm	< 0.75	0.75 - 3.0	> 3.0
Permeability			
EC of irrigation water, mmho/cm	> 0.5	< 0.5	< 0.2
SAR[c]	< 6.0	6.0 - 9.0	> 9.0
Specific ion toxicity[d]			
From root absorption			
Sodium (evaluate by SAR)	< 3	3.0 - 9.0	> 9.0
Chloride			
me/l	< 4	4.0 - 10	> 10
mg/l	< 142	142 - 355	> 355
Boron, mg/l	< 0.5	0.5 - 2.0	2.0 - 10.0
From foliar absorption[e] (sprinklers)			
Sodium			
me/l	< 3.0	> 3.0	-
mg/l	< 69	> 69	-
Chloride			
me/l	< 3.0	> 3.0	-
mg/l	< 106	> 106	-
Miscellaneous[f]			
NH_4 - N, NO_3 - N, mg/l for sensitive crops	< 5	5 - 30	> 30
HCO_3 (only with overhead sprinklers)			
me/l	< 1.5	1.5 - 8.5	> 8.5
mg/l	< 90	90 - 520	> 520
pH	Normal range	6.5 - 8.4	-

[a] Interpretations are based on possible effects of constituents on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crop, soil, and method of irrigation.

[b] Assumes water for crop plus needed water for leaching requirement (LR) will be applied. Crops vary in tolerance to salinity. Refer to tables for crop tolerance and LR. The mmho/cm x 640 = approximate total dissolved solids (TDS) in mg/l or ppm; mmho x 1,000 = micromhos.

[c] SAR (sodium adsorption ratio) is calculated from a modified equation developed by U.S. Salinity Laboratory to include added effects of precipitation and dissolution of calcium in soils and related to $CO_3 + HCO_3$ concentrations.

To evaluate sodium (permeability) hazard: $$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}\left[1 + (8.4 - pHc)\right]$$

pHc is calculated value based on total cations, Ca + Mg, and $CO_3 + HCO_3$. Calculating and reporting will be done by reporting laboratory.

SAR can be reduced if necessary by adding gypsum. Amount of gypsum required (GR) to reduce a hazardous SAR to any desired SAR (SAR desired) can be calculated as follows:

$$GR = \left[\frac{2Na^2}{SAR^2 \text{ desired}} - (Ca + Mg)\right] 234$$

Note: Na and Ca + Mg should be in me/l. GR will be in lbs. of 100 percent gypsum per acre foot of applied water.

[d] Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use salinity tolerance tables). For boron sensitivity, refer to boron tolerance tables.

[e] Leaf areas wet by sprinklers (rotating heads) may show a leaf burn due to sodium or chloride absorption under low humidity/high evaporation conditions. (Evaporation increases ion concentration in water films on leaves between rotations of sprinkler heads.)

[f] Excess N may effect production or quality of certain crops; e.g., sugar beets, citrus, avocados, apricots, etc. (1 mg/l NO_3 - N = 2.72 lbs. N/acre foot of applied water.) NCO_3 with overhead sprinkler irrigation may cause a white carbonate deposit to form on fruit and leaves.

Table 4-7. Water Quality Objectives for Agricultural Water Use

Element	Maximum concentration[a] (mg/l)	
	Irrigation supply[b]	Livestock watering
Aluminum	5.0	5.0
Arsenic	0.1	0.2
Beryllium	0.1	-
Boron	0.75	5.0
Cadmium	0.01	0.05
Chromium	0.10	1.0
Cobalt	0.05	1.0
Copper	0.2	0.5
Fluoride	1.0	2.0
Iron	5.0	-
Lead	5.0	0.1[d]
Lithium	2.5[c]	-
Manganese	0.2	-
Mercury	-	0.01
Molybdenum	0.01	0.5
Nickel	0.2	-
Nitrate + Nitrite	-	100
Nitrite	-	10
Selenium	0.02	0.05
Vanadium	0.1	0.10
Zinc	2.0	25

[a] Values based primarily on "Water Quality Criteria 1972" National Academy of Sciences-National Academy of Engineers, Environmental Study Board, ad hoc Committee on Water Quality Criteria furnished as recommended guidelines by University of California Agricultural Extension Service, January 7, 1974; maximum values are to be considered as 90 percentile values not to be exceeded.

[b] Values provided will normally not adversely affect plants or soils; no data available for mercury, silver, tin, titanium, and tungsten.

[c] Recommended maximum concentration for irrigation citrus is 0.075 mg/l.

[d] Lead is accumulative and problems may begin at threshold value (0.05 mg/l).

Water Quality Objectives for Specific Inland Surface Waters, Enclosed Bays and Estuaries

Certain water quality objectives have been established for selected surface and groundwaters; these objectives are intended to serve as a water quality baseline for evaluating water quality management in the basin. Median values, shown in Table 4-8 for surface waters, are based on available data.

It must be recognized that the median values indicated in Table 4-8 are values representing gross areas of a sub-basin. Specific water quality objectives for a particular area may not be directly related to the objectives indicated. For example, the range of average values for Total Dissolved Solids (TDS) in the Salinas River Sub-basin above Spreckles is from 216 to 2400 mg/l. Therefore, application of these objectives must be based upon consideration of the surface and groundwater quality naturally present; i.e., waste discharge requirements must adhere to the previously stated "General Objective" and issuance of requirements must be tempered by consideration of beneficial uses within the immediate influence of the discharge, the existing quality of receiving waters, and water quality objectives. Consideration of beneficial uses includes: (1) a specific enumeration of all beneficial uses potentially to be affected by the waste discharge, (2) a determination of the relative importance of competing beneficial uses, and (3) impact of the discharge on existing beneficial uses. The Regional Board will make a judgment as to the priority of dominant use and minimize the impact on competing uses while not allowing the discharge to violate receiving water quality objectives.

As part of the State's continuing planning process, data will be collected and numerical water quality objectives will be developed for those mineral and nutrient constituents where sufficient information is presently not available for the establishment of such objectives.

Objectives for Groundwater

The following objectives apply to all groundwaters of the basin.

Tastes and Odors

Groundwaters shall not contain taste or odor-producing substances in concentrations that adversely affect beneficial uses.

Bacteria

In groundwaters used for domestic or municipal supply (MUN) the median concentration of coliform organisms over any seven-day period shall be less than 2.2/100 ml.

Chemical Constituents

Groundwaters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, sub-chapter 1, Group 1, Article 4, Section 7019, Tables 2, 3, and 4.

Groundwaters designated for use as agricultural supply (AGR) shall not contain concentrations of chemical constituents in amounts that adversely affect such beneficial use. Interpretation of adverse effect shall be as derived from the University of California Agricultural Extension Service guidelines provided in Table 4-6.

In addition, waters used for irrigation and livestock watering shall not exceed the concentrations listed for these uses in Table 4-7. No controllable water quality factor shall degrade the quality of any groundwater resource or adversely affect long-term soil productivity. The salinity control aspects of groundwater management will account for effects from all sources.

Radioactivity

Groundwaters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the limits specified in California Administrative Code, Title 17, Chapter 5, Sub-chapter 1, Group 1, Article 4, Section 7019, Table 5.

Objectives for Specific Groundwaters

As previously stated under "Water Quality Objectives for Specific Inland Surface Waters, Enclosed Bays and Estuaries", certain water quality objectives have been established for selected groundwaters; these objectives are intended to serve as a water quality baseline for evaluating water quality management in the basin. The median values for groundwaters are shown in Table 4-9.

The restrictions specified for Table 4-8 are applicable to the values indicated in Table 4-9; i.e., the values are at best representative of gross areas only. Groundwaters in the Upper Valley of

Table 4-8. Median Surface Water Quality Objectives, mg/l [a]

Sub-basin/subarea	TDS	Cl	SO_4	B	Na
Santa Ynez					
Cachuma Reservoir	600	20	220	0.4	50
Solvang	700	50	250	0.4	60
Lompoc	1000	100	350	0.4	100
Santa Maria					
Cuyama River (Near Garay)	900	50	400	0.3	70
Sisquoc River (Near Garay)	600	20	250	0.2	50
Soda Lake	b	b	b	b	b
San Luis Obispo					
Santa Rosa Creek	500	50	80	0.2	50
Chorro Creek	500	50	50	0.2	50
San Luis Obispo Creek	650	100	100	0.2	50
Arroyo Grande Creek	800	50	200	0.2	50
Salinas River					
Salinas River					
Above Bradley	250	20	100	0.2	20
Above Spreckles	600	80	80	0.2	70
Gabilan Tributary	300	50	50	0.2	50
Diablo Tributary	1200	80	700	0.5	150
Nacimiento River	200	20	50	0.2	20
San Antonio River	250	20	80	0.2	20
Carmel River	200	20	50	0.2	20
Monterey Coastal					
Big Sur River	200	20	20	0.2	20
Pajaro River					
at Chittenden	1000	250	250	1.0	200
San Benito River	1400	200	350	1.0	250
Llagas Creek	200	10	20	0.2	20
San Lorenzo River					
Boulder Creek	150	10	10	0.2	20
Zayante Creek	500	50	100	0.2	40
San Lorenzo River					
Above Bear Creek	400	80	80	0.2	50
At Check Dam	250	80	60	0.2	20

[a] Objectives shown are median annual values based on data averages over the referenced study period, objectives are based on preservation of existing quality or water quality enhancement believed attainable following control of point sources.

Table 4-9. Median Groundwater Objectives, mg/l [a]

Sub-basin/subarea	TDS	Cl	SO_4	B	Na	N [b]
Santa Ynez						
Santa Ynez	600	50	10	0.5	20	1
Santa Rita	1500	150	700	0.5	100	1
Lompoc	1500	350	500	0.5	250	1
Santa Maria						
S.M. Valley (Garey)	800	60	400	0.2	70	5
S.M. Valley (Coastal)	1000	80	500	0.2	100	5
Cuyama Valley	1500	80	-	0.4	-	5
Soda Lake	c	c	c	c	c	c
San Antonio Creek	600	150	150	0.2	100	5
Santa Barbara Coastal						
Goleta	1000	150	250	0.2	150	5
Santa Barbara	700	50	150	0.2	100	5
Carpinteria	700	100	150	0.2	100	7
San Luis Obispo						
Santa Rosa	700	100	80	0.2	50	5
Chorro	1000	250	100	0.2	50	5
San Luis Obispo	900	200	100	0.2	50	5
Arroyo Grande	800	100	200	0.2	50	10
Salinas River						
Upper Valley	600	150	150	0.5	70	5
Upper Forebay	800	100	250	0.5	100	5
Lower Forebay	1500	250	850	0.5	150	8
180 foot Aquifer	1500	250	600	0.5	250	1
400 foot Aquiter	400	50	100	0.2	50	1
Pajaro River						
Hollister	1200	150	250	1.0	200	5
Tres Pinos	1000	150	250	1.0	150	5
Gilroy	300	20	50	0.2	20	5
San Lorenzo River						
Near Felton	100	20	10	0.2	10	1
Near Boulder Creek	250	30	50	0.2	20	5

[a] Objectives shown are median values based on data averages over the referenced study period; objectives are based on preservation of existing quality or water quality enhancement believed attainable following control of point sources.

[b] Measured as Nitrogen.

[c] Groundwater basin currently exceeds usable mineral quality.

the Salinas River Sub-basin have average Total Dissolved Solids (TDS) concentrations that range from 300 mg/l to over 3000 mg/l. Therefore, application of these objectives must be consistent with the "General Objective" previously stated in this chapter and synchronously reflect the actual groundwater quality naturally present. The Regional Board must afford full consideration to (1) beneficial uses potentially to be affected by the waste discharge, (2) competing beneficial uses, (3) degree of impact on existing beneficial uses, (4) receiving water quality and (5) water quality objectives, before adjudging priority of dominant use and promulgating waste discharge requirements.

As part of the State's continuing planning process, data will be collected and numerical water quality objectives will be developed for those mineral constituents where sufficient information is presently not available for the establishment of such objectives.

Chapter 5 Implementation Plan

CHAPTER 5. IMPLEMENTATION PLAN

Recommended water quality control plans are described herein for the Central Coastal Basin. The diverse nature of the basin and factors influencing water quality require consideration of geographic sub-basins for most point source measures. Additionally, topical discussions are provided relative to management of industrial wastes, solid wastes, agricultural water and wastes, urban runoff, construction, logging and mining operations, and individual disposal systems. Facility plans and other recommended control actions are described. In some cases, several acceptable options are described with preference given to a recommended plan or strategy or implementation approach.

The Central Coastal Basin environment is described in some detail in Chapter 11; however environmental sensitivity aspects relative to wastewater disposal are included in Chapter 6. Land uses and economy are described in Chapter 12. The basin environment and economy can be related to the kinds of water quality problems which predominate this area. Groundwaters are highly mineralized in several sub-basins and most streams are ephemeral. Agricultural and oil extraction activities predominate and each has a potential effect on groundwater salinity. These and other water quality problems are described in more detail in Chapter 14. Salt control is emphasized in the plan, particularly as related to municipal dischargers to land, agricultural practices and conjunctive management of surface and groundwater resources. Water resource management is described in Chapter 13.

The long rugged coastline provides a scenic outlook and habitat for many forms of marine life. Much of the basin is mountainous; the areas of more intensive land use occur in the valleys and the coastal zone. The larger coastal communities utilize the ocean for disposal of treated wastewater. This practice will be upgraded by conformance with the plan.

Selection of implementation plans is based on the protection of beneficial uses described in Chapter 2 and water quality objectives and the nondegradation policy contained in Chapter 4. Treatment levels considered necessary for various municipal facility plans have been identified in terms of their relevance to various methods of disposal. Discussions of effluent disposal to ocean, estuary, stream or land, and wastewater reclamation and sludge disposal aspects are included in the following section. Treatment levels were selected for various municipal wastewater management alternatives; these are described in Chapter 16 in terms of facilities required, costs and functional aspects. These facility plans are compared in terms of environmental impact aspects in Chapter 17. Selection procedures for municipal treatment and disposal facility plans were more rigorous than other topics because the major objectives of this basin planning effort relate directly to federal and state grant programs for municipal facilities.

Implementation plans are provided for industrial wastewater management, solid waste management; and non-point sources such as urban runoff, agricultural wastewater management, logging and construction activities and industrial wastewater disposal practices. In addition, policies and prohibitions are described which affect water quality management.

POINT SOURCE MEASURES

Water quality control plans to regulate point source wasteloads in the Central Coastal Basin have been developed to insure protection of beneficial uses of water described in Chapter 2 and water quality objectives and the nondegradation policies described in Chapter 4. In addition, effluent limits applicable to various disposal modes and waste discharge prohibitions described in this chapter influenced plan selection. Point source wastes are generated by residential, commercial, industrial, solid wastes and certain recreational activities; other wastes are considered under the category of non-point source wasteloads and are discussed in the appropriate sections of this chapter.

Effluent Limits

Effluent limitations for disposal of treated point source wastes are based on the water quality objectives for the area of effluent disposal, applicable state and federal policies and effluent limits, and the water quality objectives and policies which in turn are based on beneficial uses established for the various water quality segments. Decisions in treatment process selection are discussed for each of the four general disposal modes considered; stream disposal, estuarine disposal, ocean disposal and land disposal. There is no discussion provided for disposal to lakes or confined sloughs since this is prohibited. Separate discussions of treatment for wastewater reclamation and reuse and sludge processing and disposal are also provided.

The following discussions made reference to treatment process arrangements appropriate in different situations. For easy reference, Table 5-1 is provided to describe the type of treatment, process arrangements, and the appropriate disposal options for each of eight treatment levels. Treatment levels, as used in this report, are designated by Roman numerals I - VIII, each corresponding to the particular type of treatment described in Table 5-1.

Stream Disposal

Most of the streams in the Central Coastal Basin are ephemeral in character. In most cases, there are periods during the summer months when little or no flow exists in the stream channels. In several instances, the flow that does exist during the dry season is composed of irrigation runoff or wastewater treatment plant effluent. Usually even these flows infiltrate into the stream bed a short distance downstream of their point of input. In such instances, the concept of receiving water assimilative capacity has little meaning. The disposal of wastewaters in ephemeral streams must be accomplished in such a manner as to safeguard the public health and prevent nuisance conditions and where possible should provide benefits of stream flow augmentation. When recharge of a useful groundwater basin occurs, even if the recharge is incidental, the impact on groundwater quality must be considered.

There are a few streams in the basin which flow on a year-round basis and which support an inland fishery. Disposal of wastewaters to such streams requires that essentially all of the oxygen demanding substances and toxicity be removed.

The principal factors governing treatment process selection for stream disposal are federal effluent limits, state public health regulations, and water quality requirements for beneficial use protection. As a minimum, secondary treatment (level II), as defined by the Environmental Protection Agency, is required in all cases. See Chapter 9. (Guidelines for best practicable treatment would likewise apply in these cases; these guidelines encourage further oxidation or removal of ammonia with additional emphasis on oxygen demand and suspended solids (level III). Where water contact recreational use is to be protected, the State Health Code, Title 17, paragraph 8047, requires disinfection to an MPN of 2.2/100 ml with effluent filtration (level IV). Where rapid percolation occurs, conventional secondary treatment is currently adequate. Compliance with these regulatory guidelines establishes the minimum treatment processes for stream disposal as level IV (biological oxidation with nitrification, disinfection, and filtration) for most stream discharge cases in the Central Coastal Basin. Detoxification is also required where fishery protection is a concern; detoxification would include effluent dechlorination and compliance with EPA effluent limits for identified toxicants, pursuant to section 307 of the Federal Water Pollution Control Act. Source control of specific toxicants will be necessary to comply with the Act.

Estuarine Disposal

The receiving waters in this category may be divided into two groups: shallow waters of an open bay and confined tidal estuaries, lagoons or narrow embankments. Flushing action is usually present in a shallow open bay and natural dispersion and dilution is available on a limited scale. In confined waters, flushing action is limited or may be nonexistent except during periods of high stream inflow or storms. Since shorelines frequently are heavily developed and the waters extensively used, requirements for wastewater disposal into confined areas are often the most stringent of any for marine receiving waters. The "Water Quality Control Policy for Enclosed Bays and Estuaries of California", adopted by the State Water Resources Control Board basically prohibits the discharge of waste to most bays and estuaries in the State.

Water quality objectives limit any discharges which would raise the natural nutrient levels to an extent that nuisance algal blooms or other aquatic growths occur. Excessive eutrophication in coastal estuaries of California often is characterized by floating and stranded mats of the green marine seaweeds Enteromorpha and Ulva; these algae generally grow on mud or other substrates in estuarine water and can produce nuisance conditions along affected shorelines. These algae have a high sulfur content and emit foul smelling hydrogen sulfide and mercaptans during decomposition. Caution should be given in determining control measures for estuaries as many of the seasonal algal growths which occur on mud flats are natural and may not be significantly magnified by waste discharges in the watershed. Where

Table 5-1. Treatment Requirements for Selected Disposal Options

Treatment level	Type of treatment	Treatment processes	Appropriate disposal option
I	Physical-chemical with disinfection[a]	Sedimentation with chemical addition, chlorination, dechlorination	Possible ocean discharge option where secondary treatment not cost-effective
II	Biological secondary with disinfection[a]	Sedimentation, carbonaceous oxidation, chlorination, dechlorination	Ocean discharge. Irrigation and/or percolation systems, where nitrate is not a problem in groundwater
III	Biological nitrification with disinfection	Sedimentation, biological oxidation with nitrification, chlorination, dechlorination	Discharge to streams where recreational use is restricted
IV	Biological nitrification, filtration with disinfection	Sedimentation, biological oxidation with nitrification, effluent filtration, chlorination, dechlorination	Discharge to streams where unrestricted recreational use occurs
V	Biological nitrification and denitrification with disinfection	Sedimentation, biological oxidation with nitrification, denitrification, chlorination	Irrigation and/or percolation systems where nitrate is a problem in groundwater
VI	Physical-chemical-biological with disinfection	Sedimentation with chemical addition, oxidation with nitrification, denitrification, effluent filtration, chlorination, dechlorination	Recreational impoundments or discharge where eutrophication is a problem
VII	Partial demineralization or lime soda softening of water supply plus biological nitrification and denitrification of wastewater with disinfection	Water supply - lime soda softening or partial demineralization. Wastewater - sedimentation, biological sedimentation, biological oxidation with nitrification, denitrification, chlorination	Spray irrigation and percolation systems where groundwater nitrate and TDS concentrations are a problem
VIII	Partial demineralization of wastewater, biological nitrification and denitrification with disinfection	Sedimentation, biological oxidation with nitrification, denitrification, effluent filtration, partial demineralization, chlorination	Spray irrigation and percolation systems where groundwater nitrate and TDS concentrations are a problem

[a] Deep water ocean discharges where the effluent field is normally submerged may not require continuous disinfection.

eutrophication problems are apparent, level VI treatment should be provided for discharges to affected waters.

Ocean Disposal

Process selection for ocean discharge is less clear than either the stram or estuary disposal cases. The present Federal guidelines for secondary treatment (level II) apply to ocean discharges; the State Ocean Plan establishes different effluent limits achievable by alternative processes, such as physical-chemical treatment (level I). Effluent quality requirements in the State Ocean Plan stress control of floatables, solids and toxicants. There is opposition to the direct order for secondary treatment in the case of discharge through long deep outfalls to marine waters. Relevant treatment may well be other than secondary and more cost-effective alternatives may be apparent. A recent report to the President by the National Water Commission voices such concern. Such concern may lead to a change in the Federal Water Pollution Control Act.

Accordingly, where treatment plant upgrading is underway, secondary treatment is accepted; where treatment plant upgrading is not yet underway achievement of the secondary treatment (level II) requirement now mandated by federal guidelines should be achieved by means of staging levels of treatment. Primary treatment (level I) should be achieved as an interim measure; secondary treatment (level II) should be later achieved as this issue is clarified and more grant funds become available. Funding of treatment projects under federal-state grant projects can be expected to proceed with reference to State priorities wherein limited funds will be applied to the most needed projects. Upgrading of water quality control facilities discharging to the ocean should be directed clearly to established needs on a case-by-case basis. Higher priority is suggested for such improvements as ocean outfall extensions, odor control, enhanced removal of toxicity or floatables, and increase in plant capacity as appropriate; lower priority should be given for cases of plant upgrading from primary to secondary treatment for deep ocean discharge unless alternatives explored clearly indicate this is cost-effective and treatment for ocean disposal is believed to be hazy. It is probable that funds will be too limited for realization of the 1977 goal for secondary treatment.

Land Disposal

Principal factors affecting treatment process selection for land disposal are the nature of the soils and groundwaters in the area considered for disposal and, where irrigation is involved, the nature of the crops to be produced. Wastewater characteristics of particular concern are total salt content, nitrate, boron, coliform bacteria and potential disease vectors. Where percolation alone is considered, the nature of underlying groundwaters is of particular concern and treatment processes should be tailored to insure that local groundwaters are not degraded. Nitrate removal (level V) would be required in many cases where percolation is to usable groundwater basins; nitrate removal would not necessarily be required and level II treatment may be adequate where recharge was for other purposes such as prevention of salinity intrusion or where soil percolation constraints do not require further treatment. Monitoring in the immediate vicinity of the disposal site would be required in either case and where the need for nitrate removal is not clear, such removal would be considered as a possible future stage depending on monitoring results. Where irrigation is practiced and well controlled, this method will reduce nitrate concerns in the dry season as vegetative uptake will utilize soluble nitrates which would otherwise move into groundwater under a percolation operation. Demineralization techniques or source control of total dissolved solids would be necessary in some inland areas where groundwaters have been or may be degrated. See Chapter 6. These approaches are covered by treatment levels VII and VIII. Presence of excessive salinity, boron or sodium could be a basis for rejection of crop irrigation with effluents.

State Health Department regulations described in Title 17 of the Health Code stipulates the disinfection required for specific crops. In some cases, such as pasture for milking animals, the California Administrative Code requires oxidation with disinfection to a median of 23 MPN/100 ml. The Environmental Protection Agency guidelines for secondary treatment do not now apply to land disposal cases; however, many municipal treatment facilities in this area would be expected to conform with federal guidelines, since this minimum treatment level is desirable for most land disposal operations. Reasons for this include the desirability for effective solids removal for percolation bed operations and the need to reduce odor and general nuisance in use of wastewater effluents in irrigation operations. Disinfection provisions would be as relevant to the disposal method. Oxidation ponds may be cost-effective in some locations and would be equivalent to level II treatment.

Reclamation and Reuse

Treatment process selection relative to reclamation of wastewater is dependent upon the intended reuse. Where irrigation reuse or groundwater recharge is intended, the treatment level will depend on conditions described under land disposal. Clearly, the nature of the crop to be irrigated, soil percolation, and groundwater character are important considerations. Where reuse is extended to water contact recreation, provisions of Title 17 will apply, notably paragraph 8047 which specifies level IV treatment as a minimum. Where golf course irrigation is practiced, this level of treatment may be adequate. However, where more complete reclamation is envisioned, such as creation of recreational lakes for fishing, swimming, and water skiing, level VI treatment will be necessary to minimize algae growths and to encourage fish propagation. Comparable treatment may also be needed for industrial water supplies used for cooling and uses where algae growth in transfer channels or cooling towers is of concern. Nitrogen removal and demineralization processes may also be necessary for selected reclamation projects as discussed under land disposal.

The State Department of Public Health has provided guidelines for reclaimed water uses involving domestic water supply. Three uses of reclaimed water are considered in a department position paper:

1. groundwater recharge by surface spreading

2. direct injection into aquifers suitable for domestic water use

3. direct recycling of reclaimed water into a domestic water system or storage facility.

The State Department of Health has expressed concern that health risks from the use or reclaimed wastewater may arise from pathogenic organisms, toxic chemicals and from long-term health effects associated with stable organic materials which may remain after treatment. Accordingly, a conservative position has evolved which can be summarized as follows:

1. Surface spreading of small amounts of reclaimed water to underground basins has the greatest potential; however, near term proposal plans which involve recharge of substantial volumes of reclaimed water into a small basin are not recommended.

2. Injection of reclaimed water for groundwater replenishment is not recommended as a near term measure; however, injection may be considered as a future option and for saline water repulsion, particularly where injection is to the brackish water zone.

3. Direct recycling to a domestic water supply is not considered acceptable within the next decade because of uncertain health and social implications. The State Department of Health can be expected to reject such direct recycling alternatives although this may be retained as a future option.

Sludge Processing and Disposal

Sludge treatment and disposal is usually the most difficult aspect of wastewater treatment. Biological sludges have a higher nutrient content than primary treatment sludges and are thus more desirable as a soil conditioner, but handling problems are compounded. Chemical precipitation will produce a great quantity of sludge that is composed of inorganic material. Such sludges may be digested but require greater digestion tank capacity than is necessary for biological sludges. The large inorganic content of chemical precipitation sludges may also render them less desirable as a soil conditioner.

Burial of digested sludge or incinerated residues, often mixed with garbage and other solid wastes, has been a common method of disposal. Dewatering is generally economically desirable. Soil conditioning as a means of digested sludge disposal and of returning humus material and nutrients to the soil has been practiced in many parts of the world for many years. Liquid sludge, heat-dried sludge, dewatered sludge and composed material have all been used successfully as soil conditioners. Some means of sterilizing the sludge (such as heat drying or wet combustion) is usually required prior to unrestricted sale to the public. Experience has shown that demand for such a product is generally limited or seasonal and that some disposal method is necessary.

Examples of the disposal of liquid or dewatered digested sludge as a soil conditioner are numerous. Some treatment plants have contracts with local farmers for the use of digested sludge in agriculture. This practice is widespread in Great Britain and is becoming more popular in the United States. Dewatered and air-dried sludge cake has also been used in many major city parks. Most communities in the Central Coastal Basin dispose of sludge in liquid or dewatered form on land fills, dump sites, or on local farms. Continuation of this practice is recommended where beneficial use of sludge as a soil conditioner is not feasible.

Many of the world's major coastal cities have discharged sludge to the ocean for years. This practice has in some cases resulted in very detrimental conditions, while in others, significant impacts have not been shown. The federal government and many state governments have banned the use of federal and state monies in any system that returns sludge to the receiving waters. Some states have banned the practice outright. The contention of the regulatory agency is that return of the sludge negates the purpose of the wastewater treatment process. Though controversial, this legal ban has shifted advantages away from ocean disposal to land disposal and reclamation or to incineration, depending on local conditions. Land is more readily available for sludge disposal or use on agricultural land in the Central Coastal Basin than in more intensively urbanized areas of California.

Load Reductions

Table 5-2 shows the estimated flow rates and loadings of BOD, suspended solids, nitrogen and phosphorus for various locations in the basin for 1970, 1980, and 2000. The flows in many service areas will be consolidated and treated at regional facilities as indicated in Table 5-2. Reductions in Biochemical oxygen demand (BOD), suspended solids (SS), nitrogen (N), and phosphorus (P) loadings were made by applying treatment removal percentages to the influent loadings as presented in Table 5-3. Load reductions shown for 1980 and 2000 levels of development provide for at least the minimum 85 percent BOD and suspended solids removal and necessary disinfection to comply with Federal effluent limit requirements.

MUNICIPAL WASTEWATER MANAGEMENT

Municipal wastewater conveyance, treatment and disposal facilities recommended for the Central Coastal Basin are described in the following pages. Planning for these facilities was accomplished at two levels; for the present through 1979, more detailed feasibility level planning was performed; for the period 1980 to 2000, reconnaissance level planning of less detail was performed. Feasibility level planning was directed toward the identification of facilities which provide the most economical and environmentally protective water quality management system. Reclamation possibilities are encouraged where practicable. These facilities are recommended for further detailed study at the project level. Reconnaissance level planning was designed to identify projects which appear to be most logical and effective for future implementation and those which require more detailed study at the feasibility level of planning.

Implementation plans for municipal facilities are described in geographic sequence by hydrographic sub-basin and in some cases by regions within a sub-basin. Hydrographic sub-basins are identified in Chapter 1; see Figure 1-1. An overview of the Central Coastal Basin plan for major municipal facilities is provided in Figure 5-1; this map shows facility consolidations and disposal operations. Facility plans are also summarized in Table 5-4 in terms of recommended first stage and treatment level design flow, first stage and total planning period capital and operating costs, and primary disposal modes. Treatment levels (I-VIII) are as defined in Table 5-1. Implementation aspects are summarized with the recommended plan descriptions and in Table 5-5. However, general criteria regarding selection of arrangements and financial aspects, included in Chapter 16, are important in plan implementation, particularly where consolidation of facilities or other factors require a change in local institutional and financial practices or where financial hardships require special remedies.

Where only a single discharge is involved, assuming it has the appropriate institutional capability, it is the management agency and there are no real participating local contracting agencies. In such cases, the management agency has full responsibility for collection, treatment, disposal, and, if required, reclamation of wastewater. In unincorporated areas which do not presently have a wastewater agency, creating a County Service Area (CSA) is the easiest and most flexible solution.

Where a regional system is used, responsibilities are divided among the agencies. This is accomplished by designation of a management agency through a joint powers agreement. The parties to this agreement are shown in Table 5-5 as "participating agencies." Generally, these are existing agencies which presently process a substantial portion of the region's wastewater. The management agency can either be one of the participating agencies (prime contractor agency) or a separate administration body (umbrella agency). In each case it will have the responsibility for treatment, disposal, and, if necessary, reclamation of wastewater. If the management agency is a

Fig. 5-1. Implementation Plan for Municipal Wastewater Facilities

Table 5-2. Waste Load Reductions at Municipal Treatment Plants

Treatment plant	Year	Flow rate, (mgd)	Waste loading (lbs/day)							
			BOD_5		Suspended solids		Total nitrogen		Total phosphorus	
			Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
Santa Cruz Coastal Sub-basin										
Ben Lomond Conserv. Facility	1970	0.007	18	2	22	2	3	3	1	1
	1980	0.007	18	2	22	2	3	3	1	1
	2000	0.007	18	2	22	2	3	3	1	1
Big Basin State Park	1970	0.075	33	3	63	6	54	49	1	1
	1980	0.169	74	7	142	14	122	110	1	1
	2000	0.237	104	10	199	20	171	154	2	2
Davenport	1970	0.020	17	15	17	6	4	4	1	1
	1980	0.054	45	4	45	4	11	10	3	3
	2000	0.101	84	8	84	8	21	19	5	4
San Lorenzo Valley Sub-basin										
Boulder Creek[a]	1970	NO DATA								
Big Basin Woods[a]	1970	0.005	8	1	13	1	2	2	0	0
San Lorenzo Valley C.W.D.[a]	1970	0.010	17	2	22	2	4	4	1	1
Santa Cruz	1970	6.264	12,200	8,500	22,800	8,300	730	700	730	700
	1980	13.516	24,680	2,468	35,535	3,553	3,091	2,782	1,211	911
	2000	21.012	38,300	3,830	55,145	5,514	4,762	4,286	1,877	1,407
Scotts Valley[a]	1970	0.035	61	6	29	3	7	6	2	2
Rolling Woods[a]	1970	0.007	12	1	9	1	3	3	5	4
Aptos-Soquel Sub-basin										
East Cliff[a]	1970	3,500	5,840	4,090	5,015	1,715	1,460	1,385	175	165
Aptos[a]	1970	0.726	1,210	850	910	310	160	152	60	57
Sand Dollar Beach[a]	1970	–	96	10	116	12	28	25	6	5
Monterey Bay Academy	1970	0.064	150	105	180	63	26	25	5	5
Pajaro River Sub-basin										
Watsonville	1970	6.300	11,700	8,300	11,700	4,100	2,630	2,500	530	500
	1980	10.600	18,800	1,900	19,000	1,900	4,430	4,000	890	650
	2000	17.700	31,100	3,120	31,700	3,170	7,400	6,500	1,470	1,100
Gilroy-Morgan Hill	1970	1.810	3,260	2,260	3,020	1,070	262	249	13	13
	1980	8.246	13,351	1,335	12,748	1,275	1,203	1,083	94	71
	2000	17.734	30,955	3,095	29,704	2,970	2,840	2,556	235	176
San Juan Bautista[b]	1970	0.113	190	20	265	26	12	11	3	2
Hollister	1970	0.468	1,535	1,075	1,140	390	470	423	63	47
	1980	0.750	2,250	225	1,874	182	636	573	86	64
	2000	1.206	3,730	373	2,995	299	1,061	955	145	109
Hollister Airport[b]	1970	0.008	13	9	20	7	3	3	2	2
San Benito County Hospital[b]	1970	0.050	95	67	83	28	21	20	4	4
Tres Pinos C.W.D.	1970	0.054	100	70	87	31	22	21	4	4
	1980	0.123	230	23	200	20	50	45	9	7
	2000	0.404	750	75	650	65	165	150	31	24
Salinas River Sub-basin										
Castroville[c]	1970	0.225	375	37	375	37	94	83	19	14
Oak Hills[c]	1970	0.030	50	35	75	26	12	12	2	2
Marina[c]	1970	0.482	980	98	1,210	121	101	91	56	42
Fort Ord[c]	1970	2.880	6,700	670	8,690	869	1,200	1,080	240	180
Salinas – Main[c]	1970	5.170	10,100	1,010	13,000	1,300	2,160	1,944	194	146
Toro Park[c]	1970	0.117	98	68	98	34	49	46	8	8
Seaside C.S.D.[c]	1970	1.580	3,620	2,520	3,050	1,050	1,782	1,692	270	257
Salinas-Alisal[c]	1970	1.140	2,350	235	2,550	255	475	428	88	66
Soledad	1970	0.280	467	327	467	167	104	100	36	35
	1980	0.418	696	69	696	69	155	140	53	40
	2000	0.703	1,172	117	1,172	117	261	235	89	67
Monterey-Salinas Reg. Plant	1980	19.810	41,056	2,060	50,133	2,500	8,534	420	1,598	80
	2000	27.830	56,731	2,800	69,131	3,500	11,944	600	2,702	110
Chualar C.S.D.	1970	0.018	40	28	45	16	13	12	2	2
	1980	0.078	110	11	123	12	37	34	7	5
	2000	0.120	170	17	189	19	57	51	10	8
Gonzales	1970	0.100	309	216	250	90	44	42	21	20
	1980	0.201	372	37	301	30	53	48	25	18
	2000	0.273	504	50	408	41	72	65	34	25

Treatment plant	Year	Flow rate, (mgd)	Waste loading (lbs/day) BOD5 Influent	BOD5 Effluent	Suspended solids Influent	Suspended solids Effluent	Total nitrogen Influent	Total nitrogen Effluent	Total phosphorus Influent	Total phosphorus Effluent
Salinas River Sub-basin (Continued)										
Soledad Prison	1970	0.520	967	97	801	80	203	183	35	26
	1980	0.627	1,165	116	965	96	245	221	42	32
	2000	0.731	1,359	135	1,126	113	285	257	49	37
Greenfield	1970	0.162	313	220	376	126	75	72	1,028	976
	1980	0.276	533	53	640	64	128	116	1,752	1,312
	2000	0.462	893	89	1,073	107	214	193	2,935	2,205
King City	1970	0.575	815	565	722	252	146	139	67	64
	1980	0.697	1,030	103	913	91	185	167	85	64
	2000	0.971	1,513	151	1,340	134	271	244	124	93
San Antonio Reservoir-North	1970	0.022	40	28	40	14	23	22	1	1
	1980	0.029	53	5	53	5	30	27	1	1
	2000	0.083	151	15	151	15	87	78	4	3
San Antonio Reservoir-South	1970	0.058	105	10	105	10	0	0	5	4
	1980	0.076	138	13	138	14	0	0	7	5
	2000	0.083	150	15	150	15	0	0	7	5
Camp Roberts	1970	1.000	2,240	224	2,700	270	415	374	83	62
	1980	1.000	2,240	224	2,700	270	415	374	83	62
	2000	1.000	2,240	224	2,700	270	415	374	88	62
Paso Robles	1970	0.905	1,460	146	2,260	226	383	345	72	54
	1980	1.141	1,953	195	2,851	285	446	402	95	71
	2000	1.530	2,585	258	3,821	382	609	549	126	95
Atascadero St. Hosp.[d]	1970	0.060	170	120	150	50	1	1	8	8
Atascadero C.S.D.	1970	0.468	324	32	500	50	7	7	19	14
	1980	1.545	1,719	172	2,613	261	56	51	98	73
	2000	2.527	2,969	297	4,524	452	91	82	170	128
Santa Margarita Elem. Sch.	1970	0.002	5	3	6	2	0	0	0	0
Hunter Liggett	1970	0.063	147	102	179	64	26	25	5	5
	1980	0.153	140	14	170	17	25	23	5	4
	2000	0.153	140	14	170	17	25	23	5	4
Oak Shores	1970	0.034	80	8	97	10	14	13	3	3
	1980	0.039	91	9	110	11	16	14	3	2
	2000	0.059	140	14	170	17	25	22	5	4
Heritage Ranch East	1980	0.145	340	34	410	41	61	56	12	9
	2000	0.278	650	65	790	79	116	105	23	17
Heritage Ranch Central	1980	0.528	1,260	126	1,530	153	220	198	44	33
	2000	1.016	2,360	236	2,860	286	425	383	85	64
Carmel River Sub-basin										
Monterey[c]	1970	2.610	6,640	664	8,430	843	1,070	963	234	176
Hidden Hills[c]	1970	0.014	33	23	40	14	0	0	0	0
Pacific Grove[c]	1970	1.300	1,990	1,390	2,200	800	188	180	179	170
Carmel S.D.	1970	0.961	2,114	211	1,566	157	311	280	48	36
	1980	0.999	2,197	219	1,627	163	323	291	50	36
	2000	1.263	2,779	277	2,058	206	409	369	63	47
Mid-Carmel Valley	1980	0.288	500	50	610	61	120	108	24	18
	2000	0.429	1,000	100	1,220	122	179	162	36	27
Upper Carmel Valley	1980	0.331	770	77	940	94	138	125	28	21
	2000	0.551	1,300	130	1,580	158	230	207	46	35
Monterey Coastal Sub-basin										
Carmel Highlands[e]	1970		NO DATA							
U.S. Navy - Point Sur	1970	0.012	20	2	30	3	6	6	2	2
	1980	0.017	28	3	42	4	8	7	2	2
	2000	0.017	28	3	42	4	8	7	2	2
Pfeiffer Big Sur State Park	1970	0.108	103	10	155	15	21	19	5	5
	1980	0.141	134	13	202	20	27	24	6	5
	2000	0.225	215	21	323	32	44	40	10	8
San Luis Obispo Sub-basin										
San Simeon	1970	0.07	160	16	180	18	35	32	18	14
	1980	0.12	280	28	300	30	60	54	30	23
	2000	0.28	650	65	700	70	140	126	70	53
Cambria	1970	0.20	380	38	420	42	100	90	50	38
	1980	0.30	580	58	630	63	150	135	75	56
	2000	0.53	1,000	100	1,100	110	260	234	130	98

Table 5-2. Waste Load Reductions at Municipal Treatment Plants (Continued) (3)

Treatment plant	Year	Flow rate, (mgd)	Waste loading (lbs/day)							
			BOD_5		Suspended solids		Total nitrogen		Total phosphorus	
			Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
San Luis Obispo Sub-basin (Continued)										
Morro Bay-Cayucos	1970	1.28	3,030	300	3,200	320	640	580	320	240
	1980	1.64	3,800	190	4,100	410	820	82	410	310
	2000	2.36	5,500	275	5,900	590	1,180	118	590	440
Los Osos-Baywood	1970	0.33	630	630	690	690	170	170	85	85
	1980	0.45	860	43	940	94	220	22	110	83
	2000	0.65	1,200	60	1,300	130	320	32	160	120
California Men's Colony	1970	0.56	1,100	110	1,200	120	280	250	140	105
	1980	0.71	1,400	70	1,500	150	360	36	180	135
	2000	0.93	1,800	90	1,900	190	460	46	230	173
San Luis Obispo	1970	3.24	7,600	760	8,100	810	1,600	1,440	800	600
	1980	4.32	10,000	500	11,000	550	2,200	220	1,100	110
	2000	6.36	15,000	750	16,000	800	3,200	320	1,600	160
Avila Beach	1970	0.12	180	140	200	70	60	57	30	29
	1980	0.17	260	26	280	28	85	77	43	32
	2000	0.29	430	43	480	48	140	126	70	53
Pismo Beach	1970	0.75	1,100	110	1,200	120	380	342	190	143
	1980	1.02	1,500	150	1,700	170	510	459	250	188
	2000	1.50	2,300	230	2,500	250	750	675	380	285
South San Luis Obispo C.S.D.	1970	1.35	3,700	370	3,900	390	780	700	390	290
	1980	2.05	4,800	480	5,200	520	1,030	925	510	390
	2000	2.77	5,500	550	6,900	690	1,390	1,250	690	520
Lopez Reservoir	1970	0.09	130	13	150	15	45	41	23	17
	1980	0.12	180	18	200	20	60	54	30	23
	2000	0.18	270	27	300	30	90	81	45	34
Soda Lake Sub-basin										
Soda Lake	1970	0.06	90	NA	100	NA	30	NA	15	NA
	1980	0.15	220	NA	250	NA	75	NA	38	NA
	2000	0.42	630	NA	700	NA	210	NA	100	NA
Santa Maria River Sub-basin										
Santa Maria[f]	1970	6.35	15,000	1,500	16,000	1,600	3,200	2,880	1,600	1,200
	1980	8.40	20,000	1,000	21,000	2,100	4,200	420	2,100	1,575
	2000	19.98	47,000	2,350	50,000	5,000	10,000	1,000	5,000	3,750
Guadalupe	1970	0.44	660	66	730	73	220	200	110	83
	1980	0.58	870	44	970	97	290	29	150	113
	2000	0.78	1,200	60	1,300	130	390	39	190	143
Cuyama Valley	1970	0.27	400	40	450	45	140	126	70	53
	1980	0.35	520	52	580	58	180	162	90	68
	2000	0.53	800	80	880	88	260	234	130	98
Santa Ynez Sub-basin										
Lompoc Valley	1970	3.79	8,900	890	9,500	950	1,900	1,710	950	713
	1980	4.94	11,000	1,100	12,000	1,200	2,400	2,160	1,200	900
	2000	9.14	13,000	1,300	14,000	1,400	2,900	2,610	1,400	1,050
Vandenberg Air Force Base	1970	1.26	2,400	240	3,600	260	630	567	320	240
	1980	1.51	2,900	290	3,100	310	760	684	380	285
	2000	2.28	4,400	440	4,800	480	1,100	990	570	428
Buellton	1970	0.17	330	33	360	36	85	77	43	32
	1980	0.40	770	77	830	83	200	180	100	75
	2000	0.70	1,300	130	1,500	150	350	315	170	128
Solvang[g]	1970	0.60	1,100	600	1,200	720	300	290	150	140
	1980	0.79	1,500	150	1,600	160	400	360	200	150
	2000	1.52	2,900	290	3,200	320	760	684	380	285
Cachuma Reservoir	1970	0.19	290	29	320	32	95	86	48	36
	1980	0.24	360	36	400	40	120	108	60	45
	2000	0.38	570	57	630	63	190	171	95	71

Table 5-2. Waste Load Reductions at Municipal Treatment Plants (Continued) (4)

Treatment plant	Year	Flow rate, (mgd)	Waste loading (lbs/day)							
			BOD_5		Suspended solids		Total nitrogen		Total phosphorus	
			Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
Santa Barbara Coastal Sub-basin										
Goleta Sanitary District	1970	5.64	13,000	9,100	14,000	4,900	2,800	2,660	1,400	1,330
	1980	9.07	21,000	2,100	23,000	2,300	4,500	4,050	2,300	1,725
	2000	22.01	51,000	5,100	55,000	5,500	11,000	9,900	5,500	4,125
Santa Barbara Area	1970	7.99	18,000	13,000	19,000	6,800	4,000	3,800	1,900	1,800
	1980	13.28	31,000	3,100	33,000	3,300	6,600	5,940	3,300	2,475
	2000	20.92	49,000	4,900	52,000	5,200	10,000	9,000	5,000	3,750
Montecito Sanitary District	1970	0.70	1,400	140	1,500	150	350	320	180	130
	1980	1.50	2,900	290	3,100	310	750	675	380	285
	2000	1.98	3,800	380	4,100	410	990	891	490	368
Summerland Sanitary District	1970	0.07	160	16	170	17	35	32	18	14
	1980	0.09	210	21	220	22	45	41	23	17
	2000	0.15	350	35	380	38	75	68	38	29
Carpinteria Sanitary District	1970	1.03	2,000	200	2,100	210	520	468	260	195
	1980	1.69	3,200	320	3,500	350	840	756	420	315
	2000	3.30	6,300	630	6,900	690	1,600	1,440	800	600

[a] Flows will be treated by Santa Cruz by 1980.

[b] Flows will be treated at Hollister by 1980.

[c] Flows will be treated at Monterey-Salinas Regional Plant by 1980.

[d] Flows will be treated at Atascadero by 1980.

[e] Flows will be treated at Carmel Sanitary District by 1980.

[f] Includes waste loadings for Santa Maria Airport and the Laguna County Sanitation District.

[g] Includes the community of Santa Ynez by 1980.

Table 5-3. Treatment Removal Percentages

Treatment level	Percent removal			
	BOD_5	Suspended solids	Total N	Total P
Primary	30	65	5	5
Secondary	90	90	10	25
Secondary with denitrification	95	90	90	25
Secondary with nutrient removal	95	95	90	90

Table 5-4. Summary of Costs for Municipal Wastewater Management Facilities

Municipal discharger	Initial stage[a] Capital cost[c]	Initial stage[a] Operation and maintenance cost[c]	Total[b] Capital cost[c]	Total[b] Operation and maintenance cost[c]	Treatment level[d]	Primary disposal mode
Santa Cruz Coastal Sub-basin						
Big Basin State Park	150	33	203	41	IV	Land
Davenport	150	14	194	22	II	Land
San Lorenzo River Sub-basin[e]						
Santa Cruz Regional Plant	24,435	684	31,870	835	II	Ocean
Pajaro River Sub-basin						
Watsonville Regional Plant	9,420	492	12,080	556	II	Ocean
Gilroy Regional Plant	9,360	437	14,570	627	II	Land
Hollister Regional Plant	6,700	378	7,150	395	II	Land
Tres Pinos	0	3	0	4	II	Land
Salinas River Sub-basin						
Monterey-Salinas Regional Plant	48,840	1,965	61,140	2,441	II	Ocean
King City	2,660	177	2,890	197	II	Land
Greenfield	200	43	306	51	II	Land
Soledad	680	54	810	67	II	Land
Chualar	360	21	401	28	II	Land
Gonzales	390	40	508	63	II	Land
San Antonio Reservoir - North	340	14	394	27	II	Land
San Antonio Reservoir - South	90	22	112	24	II	Land
Heritage Ranch East	200	17	261	43	II	Land
Heritage Ranch Central	730	33	887	80	II	Land
Paso Robles	1,686	129	1,942	144	II	Land
Shandon[f]	175	9	195	10	II	Land
Atascadero	2,900	138	3,324	165	II	Land
Carmel River Sub-basin						
Carmel C.S.D.[g]	2,910	159	3,215	181	II	Ocean
Mid-Valley[f]	180	22	232	38	II	Land
Carmel Valley[f]	370	36	473	59	II	Land
Monterey Coastal Sub-basin						
Pfeiffer Big Sur State Park	260	41	343	53	II	Land
Point Sur	0	8	0	8	II	Land
San Luis Obispo Coastal Sub-basin						
San Simeon Acres CSD	700	30	900	50	II	Land
Cambria County Water District	1,200	50	1,500	70	II	Land
Cambria Air Force Radar Station	100	10	100	10	II	Land
Moro Bay-Cayucos	3,700	220	4,800	250	V	Land
California Men's Colony	1,700	110	1,900	140	V	Land
Baywood-Los Osos[f]	5,300	90	5,600	100	V	Land
City of San Luis Obispo	5,100	570	7,800	670	VI	SLO Creek
Avila Sanitary District	1,200	35	1,300	30	II	Ocean
City of Pismo Beach	2,200	120	2,600	130	II	Ocean
San Luis Obispo County SD	2,600	180	3,100	210	II	Ocean
Lopez Recreation Area	100	30	200	40	II	Land
Santa Maria River Sub-basin						
Nipomo	2,800	60	3,100	80	II	Land
City of Guadalupe[h]						
Water treatment	1,000	50	1,300	60		
Wastewater facilities	600	70	700	80		
Total	1,600	120	1,900	140	VII	Land
City of Santa Maria[h]						
Water treatment	5,100	280	8,900	380		
Wastewater facilities	5,200	410	12,600	560		
Total	10,300	690	21,500	940	VII	Land
Laguna CSD[h]						
Water treatment	3,400	100	5,900	290		
Wastewater facilities	2,300	200	5,000	320		
Total	5,700	300	10,900	610	VII	Land
Cuyama Valley Comm. Services	100	20	200	20	V	Land

Table 5-4. Summary of Costs for Municipal Wastewater Managements Facilities (Continued) (2)

Municipal discharger	Initial stage[a]		Total[b]		Treatment level[d]	Primary disposal mode
	Capital cost[c]	Operation and maintenance cost[c]	Capital cost[c]	Operation and maintenance cost[c]		
Santa Ynez River Sub-basin						
Vandenberg	2,600	180	2,900	230	II	Ocean
Federal Correctional Institution	700	20	1,000	20	III	Santa Ynez River
City of Lompoc	200	200	900	330	III	Santa Ynez River
Vandenberg Disposal Company	700	60	2,200	100	III	Santa Ynez River
Lompoc Utility Services	200	30	1,000	50	III	Santa Ynez River
Buellton Community SD	400	60	700	80	II	Land
Solvang MID	100	60	600	80	II	Land
Santa Ynez CSD	1,900	30	2,300	40	II	Land
Cachuma CSD	100	40	300	50	II	Land
Santa Barbara Coastal Sub-basin						
Goleta Sanitary District	4,800	440	8,000	580	II	Ocean
City of Santa Barbara	4,700	550	9,700	780	II	Ocean
Montecito Sanitary District	100	130	500	150	II	Ocean
Summerland Sanitary District	1,000	20	1,000	40	II	Ocean
Carpinteria Sanitary District	1,900	140	2,900	200	II	Ocean

[a] Facilities required for 1975-1985 period to meet projected wastewater demands until 1985. Projected median flow (1980-1985 period) used to estimate O & M costs (See Table 5-2). Capital costs refined from alternative comparisons in Chapter 16 to reflect site constraints and interceptor alignments.

[b] Facilities required for 1975-2000 period to meet projected wastewater demands until 2000; O & M costs based on 1990 flows.

[c] Based on an ENR construction cost index of 2000; capital cost is $1,000; O & M cost is $1,000/year.

[d] See Table 5-1 for complete description of treatment levels.

[e] Aptos-Soquel sub-basin included in San Lorenzo River plan; Upper San Lorenzo Valley communities to conduct sewerage feasibility studies.

[f] Costs for facilities applicable only if sewerage feasibility is determined; otherwise septic tank management recommended.

[g] Carmel CSD capital costs include recent expansion to Level II treatment (3 mgd); remaining costs for interceptors and possible outfall improvements. Carmel Highlands to be connected.

[h] Acceptable alternative is partial demineralization of wastewater (level VIII treatment) to achieve comparable effluent salt content; Santa Maria Public Airport to consolidate with Santa Maria or Laguna County SD. City of Guadalupe may be allowed to retain Level II treatment with land disposal if disposal site does not percolate to useable ground waters.

Table 5-5. Institutional Arrangements

Region	Management agency	Subregion	Participating agencies	Local contracting agencies
Santa Cruz	City of Santa Cruz or Regional Management Agency[a]	Santa Cruz	City of Santa Cruz	Santa Cruz CSA 10
		East Cliffs	Santa Cruz CSD	Santa Cruz CSA 5
		Capitola	Santa Cruz CSD	
Aptos/Soquel		Aptos	Santa Cruz CSD	
		Scotts Valley	City of Scotts Valley	
San Lorenzo Valley		San Lorenzo Valley	San Lorenzo Valley CWD	
		Santa Cruz CSA 5		
		Bear Creek Estates		
Gilroy/Morgan Hill/San Martin	City of Gilroy	Gilroy	City of Gilroy	
		Morgan Hill	City of Morgan Hill	
		San Martin		County Service Area[d]
Hollister/San Juan Bautista	City of Hollister[a]	Hollister	City of Hollister	
		San Juan Bautista	City of San Juan Bautista	
		County Hospital		County of San Benito
Watsonville Region	City of Watsonville or Regional Management Agency[a]	Watsonville	City of Watsonville	
		Pajaro CSD	Pajaro CSD	
		Monterey Bay Academy		County Service Area[d]
		Corralitos		City of Santa Cruz
		Aromas		Aromas CWD
		Los Lomas-Hall/Fruitland		County Service Area[d]
Castroville/Salinas/Monterey/ Pacific Grove/Seaside	Monterey Peninsula Water Pollution Control Agency[c]	Castroville	Castroville CSD	
		Marina CWD	Marina CWD	
		Monterey	City of Monterey	
		Pacific Grove	City of Pacific Grove	
		Seaside	Seaside CSD	
		Salinas	City of Salinas	
		Ford Ord		U.S. Army
		Boronda CWD		Boronda CWD
		Monterey CSA 4d		Monterey CSA 4
		Toro Park		County Service Area[d]
		Toro Canyon		County Service Area[d]
		Gabrilan Acres		County Service Area[d]
		Bolsa Knolls		County Service Area[d]
		Oakhills		County Service Area[d]
Carmel	Carmel SD[b]	Carmel	Carmel SD	
		Pebble Beach	Pebble Beach SD	
King City	City of King City			
Greenfield	City of Greenfield			
Soledad	City of Soledad			
Chualar CSD	Chualar CSD			
Gonzales	City of Gonzales			
Shandon	San Luis Obispo CSA 16			

Table 5-5. Institutional Arrangements (Continued) (2) (2)

Region	Management agency	Subregion	Participating	Local contracting agencies
Paso Robles	City of Paso Robles[a]	Paso Robles	City of Paso Robles Templeton S.D.	
Atascadero	Atascadero CSD	Atascadero Atascadero State Hospital	Atascadero CSD	State of California
San Miguel	San Miguel SD			
San Ardo	County Service Area[d]			
Heritage Ranch	County Service Area[d]			
Big Basin State Park	County Service Area[d]			
Pfeiffer Big Sur State Park	County Service Area[d]			
San Antonio Reservoir	County Service Area[d]			
Davenport				Davenport SMD
Morro Bay/Cayucos	City of Morro Bay[b]	Morro Bay Cayucos	City of Morro Bay	 Cayucos SD
San Simeon Acres	San Simeon Acres Cm SD			
Cambria	Cambria CWD		San Simeon Hearst State Monument	State of California Dept. of Parks & Recreation
New Cuyama	County Service Area[d]			
Buellton	Buellton Cm SD			
Solvang	Solvang MID		Solvang, Santa Ynez	Santa Ynez C.S.D.
Santa Ynez	Santa Ynez Cm SD			
Lompoc, et al	City of Lompoc[a]	Lompoc Vandenberg Village Mission Hills Federal Correctional Inst.	City of Lompoc	 Lompoc Util. Serv., Park Water Co.[g] Lompoc Util. Serv., Park Water Co.[g] Federal Correctional Inst.
Lopez Recreation Area	San Luis Obispo Flood Control Zone No. 3			
Cachuma Recreation Area	Cachuma CSD			
Nipomo	County Service Area[e]			
Guadalupe	City of Guadalupe			
Laguna	Laguna CSD			
Santa Maria/Santa Maria Airport[f]	City of Santa Maria[a]	Santa Maria Santa Maria Airport	City of Santa Maria	 Santa Maria Airport Dist.
Pismo Beach	City of Pismo Beach			

Table 5-5. Institutional Arrangements (Continued) (3)

Region	Management agency	Subregion	Participating agencies	Local contracting age
South San Luis Obispo	South San Luis Obispo CSD			
Avila	Avila SD			
San Luis Obispo	City of San Luis Obispo			
Goleta	Goleta SD[b]	Goleta	Goleta SD	
		Isla Vista		Isla Vista SD
		University of California at Santa Barbara		State of California
		Santa Barbara Airport and western part of Santa Barbara		City of Santa Barbara
Santa Barbara	City of Santa Barbara			
Montecito	Montecito SD			
Summerland	Summerland SD			
Carpinteria	Carpenteria SD			

[a] Regional contractor agency created by new joint exercise of powers agreement among participating agencies.

[b] Regional contractor agency under existing joint exercise of powers agreement.

[c] Existing umbrella agency reconstituted by the addition of new participating agencies for the joint exercise of powers agreement.

[d] New county service area created by a resolution of the County Board of Supervisors. These areas are presently served by investor-owned utilities. See text.

[e] New county service area created by a resolution of the County Board of Supervisors. Portions of the proposed Nipomo service area are included in the Nipomo Community Services District and County Service Area No. 1, neither of which presently provides wastewater services. See text.

[f] A similar alternative combining Santa Maria Airport District with Laguna CSD is especially acceptable.

[g] Privately owned utility

contractor rather than umbrella type of agency, it will also be responsible for collection in its original service area. The participating agencies and local contracting agencies will be responsible for collection and will contract with the management agency for other services. The agency responsible for operation of wastewater treatment and disposal facilities is also required to comply with discharge requirements and permits issued by regulatory agencies; accordingly the operating agency must be empowered to provide all related water quality control operations including source control and monitoring within tributary sewer systems where necessary to assure compliance.

The following are recommended municipal wastewater facility plans for the Central Coastal Basin. References to discharge volumes are given to provide perspective; these are not precise but are generally indicative of present discharge rates or design capacity except where otherwise noted.

Santa Cruz Coastal Sub-Basin

The Santa Cruz Coastal Sub-basin includes no major wastewater dischargers; small dischargers (less than 0.10 mgd) in this area include the Davenport Sewer Maintenance District and the nearby Newtown area on the coast and Big Basin State Park on Waddell Creek and the Ben Lomond Conservation Facility, the latter operated by the State Division of Forestry and the California Youth Authority. Both the Big Basin and Ben Lomond facilities are located in the upper portion of the sub-basin.

The plan for Davenport (.02 mgd) stresses a change in disposal method and the equivalent of level II treatment; however, it is assigned low priority for implementation because the present discharge to a virtually inaccessible area is of small volume, dilute, and the financial impact of early implementation poses a serious economic hardship.

The plan for Big Basin State Park (.04 mgd) encourages upgraded treatment for streamflow augmentation or land disposal using irrigation techniques. Upgraded treatment to level IV for stream discharge is preferred and would enhance water quality and beneficial uses in Waddell Creek.

The plan for the Ben Lomond Conservation Facility is to retain the existing land disposal operation with level II treatment.

Implementation of the above plans for these small discharges requires no significant institutional changes; the Davenport Sewer Maintenance District will provide all of its own wastewater service through contracts to the county or a private firm; however, because a tax rate of over $30 per $100 assessed value and a cost per connection of over $450 is indicated, correction of this small facility has low priority and is not recommended until after 1980 unless the Davenport-Newtown area exhibits unusual growth. Implementation of the Big Basin State Park program should be accomplished by the State Department of Parks and Recreation before 1977; Ben Lomond facilities are adequate so long as operation and maintenance are effective.

San Lorenzo River Sub-Basin

The San Lorenzo River Sub-basin includes unsewered areas and several small waste discharges (less than 0.10 mgd) serving several areas of the San Lorenzo Valley and primary treatment and ocean disposal facilities which serve the City of Santa Cruz (7 mgd); these facilities are being expanded and upgraded to provide advanced primary treatment including chemical addition with capacity to serve 21 mgd.

Wastewaters from sewered areas of the lower San Lorenzo Valley near Scotts Valley should be transported to Santa Cruz for treatment and disposal to the ocean; accordingly, an interceptor should be constructed from Scotts Valley to Santa Cruz before 1977. Existing expanded wastewater treatment plant at Scotts Valley would be used for reclamation of at least 400,000 gallons per day during the summer months. Upstream areas currently dependent on septic tank systems should complete sewerage feasibility studies by mid 1976 to determine if sewers are required and to initiate formation of septic tank management districts where sewers are not recommended. Upstream areas recommended for sewerage facilities and the existing facilities at Boulder Creek, Big Basin Woods, and Bear Creek Estates should emphasize reclamation including irrigation reuse and streamflow maintenance. Treatment required would be dependent on reuse method; level II is acceptable for irrigation reuse and wet season release and level IV is necessary for dry season stream discharge.

Flows from the Aptos-Soquel sub-basin, including Aptos and East Cliff (Santa Cruz County Sanitation District), Sand Dollar Beach and from the currently unsewered La Selva Beach area should be conveyed through interceptors and pumping facilities to santa Cruz for treatment followed by ocean disposal or, when feasible, conveyed for use as part of a reclamation system for the Santa Cruz, San Lorenzo Valley, or Pajaro Valley areas. Treatment facilities at Aptos, East Cliff, and Sand Dollar Beach would be abandoned. Several of these areas are unsewered. However, it is anticipated that sewers will be installed within the near future. Therefore, treatment facilities at a regional plant should be provided to serve these areas when the need actually exists. Secondary treatment (level II) is recommended for ocean disposal at the Santa Cruz facility in conformance with federal effluent limits; however upgrading to secondary treatment has a lower priority than other elements of this plan. See earlier discussion of ocean disposal. Interceptors and outfall facilities should be completed before 1977; the upgrading to secondary treatment by 1977 will be dependent on funding available and could be deferred until 1979 if higher priority consolidation efforts and outfall construction as well as environmental impacts in the Neary's Lagoon area dictate that later staging of further treatment plant upgrading will help plan implementation.

In the event future reclamation of a portion or all of the wastewaters generated in the Santa Cruz and San Lorenzo Valley regions becomes feasible in the future, the reclaimed water could be reused for streamflow augmentation or supplemental water supply in the San Lorenzo Valley or for agricultural irrigation in the Pajaro Valley near Watsonville. See Chapter 6. If reclaimed water is used in the Santa Cruz area, conveyance facilities could be constructed to transport treated effluent from the regional reclamation treatment plant at the City of Santa Cruz to a reclamation plant in the San Lorenzo Valley. Reclaimed water could then be transported to Loch Lomond, Zayante and Glenwood reservoirs where it could supplement water supply or be released to Newell Creek, Zayante Creek or Soquel Creek for water quality control and streamflow augmentation. If water is required in the Pajaro Valley for irrigation in addition to what can be made available through reclamation of flows generated in the Watsonville Region, treated effluent from the regional plant in Santa Cruz could be transported to a reclamation plant at Watsonville.

Implementation of the consolidation program will be accomplished by a regional management agency responsible for wastewater conveyance, treatment and disposal. The newly formed Santa Cruz County Sanitation District and the City of Scotts Valley would be participants in the regional agency. County service areas in the upper San Lorenzo Valley or the exisitng County Water District would manage the separate facilities retained in the upper watershed; septic tank management districts would be established under county jurisdiction for unsewered areas in the San Lorenzo Valley.

Aptos-Soquel Creek Sub-Basin

Wastewater in the Aptos-Soquel Creek Sub-basin will be conveyed to Santa Cruz for treatment and disposal. Facilities and agencies affected and the elements of this plan were described in the preceding discussion of the San Lorenzo River Sub-basin. Wastewater from the small Monterey Bay Academy (less than 0.10 mgd) could be given separate treatment and land disposal or could be transported to Watsonville for treatment and disposal. Separate treatment and land disposal is recommended for the present.

Pajaro River Sub-Basin

Developed regions in the Pajaro River Sub-basin include the corridor from Morgan Hill through San Martin to Gilroy in south Santa Clara County, the Hollister area and the area around Watsonville.

Gilroy Region

Wastewaters in the Gilroy region (2 mgd) are transported to a regional treatment plant near Gilroy. In this plant, flows from Morgan Hill, Gilroy and the presently unsewered San Martin area would be treated. At the project level, efforts must be directed to the careful consideration of salt sources and the location, design and operation of the land disposal facility. See earlier discussion of land disposal. Industrial flows from Gilroy are to be included in the system. Since these flows are currently highly mineralized, groundwater supplies could be degraded as a result of imporper design and operation of the disposal facility if salt source controls are not effective. See discussion of land disposal effects in Chapter 6. Flexibility is provided wherein nitrate removal or demineralization could be provided for necessary portions of the wastewater flow if reductions in these salts is needed to protect local groundwaters. Use of irrigation techniques during the dry season and effluent percolation disposal in the wet season is recommended.

The regional secondary treatment plant and land disposal facility should adequately protect the quality of waters in the Gilroy region throughout the entire planning period. However, if higher level treatment is required at some time in the future, it is recommended that a reservoir be created for recreational purposes and supplied with the treated wastewater. Tick Canyon is a possible location for such a project.

The City of Gilroy already has a joint exercise of powers agreement to transport, treat, and dispose of wastewater from the City of Morgan Hill. It would also perform these services for the new county service area for the San Martin area. Collection would be the responsibility of the individual agencies.

Hollister Region

A water quality control system which would provide for the consolidation of all flows which are generated in the Hollister region, with the exception of those from Tres Pinos, is recommended. The existing Hollister treatment plant (1 mgd) should be expanded and upgraded by 1977 to create a Hollister regional secondary treatment plant. Interceptors should be constructed to bring flows to the regional plant from the San Benito County Hospital, the Hollister airport and the Hollister industrial system (approximately 5 mgd), although the industrial system may be maintained separately if project level studies determine this is feasible. San Juan Bautista should connect to the regional plant to upgrade treatment and provide land disposal unless project level studies show continued use of lagoons is acceptable environmentally and that a separate facility using land disposal is cost-effective.

As in the case with the Gilroy region, land disposal of wastewaters must be monitored carefully to assure that the quality of the regional groundwaters is protected. Location of disposal sites relative to groundwater protection will be critical in terms of possible future requirements for demineralization. Salt source control is stressed; if effluent salinity is not controlled to levels acceptable for disposal to local groundwaters, a more complete consolidation of facilities and partial demineralization of effluents would be required; under these circumstances, consolidation of all facilities including San Juan Bautista is recommended.

The cities of Hollister and San Juan Bautista should develop a joint exercise of powers agreement naming the City of Hollister as prime contractor agency with responsibility for transportation, treatment, and disposal of wastes if consolidation is to be accomplished. Each city will be responsible for their own sewage collection. The City of Hollister would contract with the County of San Benito to provide all wastewater services to the County Hospital.

Watsonville Region

Analysis of alternatives for water quality management for the Watsonville area show that a regional system with a treatment facility located near Watsonville is preferred. Interceptors would be constructed to transport flows from Aromas, and Los Lomas-Hall to the regional plant. Treated wastewaters would be discharged to Monterey Bay after secondary treatment through an extended outfall, used directly for irrigation, or used for injection wells to create a barrier to seawater intrusion. The present capacity of the Watsonville plant is 13.5 mgd.

It is expected that the recommended system for the Watsonville area will be adequate for protecting the quality of its waters and will provide the best allocation of water resources. The reuse of wastewater treated at the secondary level and filtered as necessary for agricultural purposes is recommended for the lower Pajaro Valley. Although overdrafting of the groundwater basin was not shown, there is evidence of sea water intrusion. Should more detailed investigations show a need for supplemental water, the Watsonville regional plant effluent could be used in several ways. The treated effluent could be used for injection wells to create a barrier to seawater intrusion; treated effluent could also be introduced into the irrigation systems to relieve pumping of the groundwater basin. Since demineralization is not inlcuded in the treatment process recommended, a careful salt balance evaluation would have to be made to insure that the use of reclaimed water would not degrade groundwaters. Preliminary salt balance computations made in this investigation indicate that the reuse of Watsonville wastewater would not cause problems especially if used near the sea coast.

If a treatment level higher than secondary is required before the end of the planning period, it is recommended that nutrient removal and TDS reduction be provided at the regional plant. The reclaimed water should then be conveyed to the lakes northeast of Watsonville for recreational use or to the Pescadero Creek Reservoir in the future to supplement municipal and industrial water supplies.

In the Watsonville region, the city or a regional agency will be the prime contractor with county districts as participants. The city or regional agency will transport, treat, and dispose of wastes from the service area. Agreements should be negotiated to provide these services to the Corralitos area, Aromas CWD, and to newly formed service areas in the Los Lomas-Hall/Fruitland areas. Individual agencies will be responsible for waste collection.

Salinas River Sub-Basin

The extensive Salinas River Sub-basin includes the Monterey Peninsula and southern coastal area of Monterey Bay, the City of Salinas, agricultural and small urban centers of the Salinas Valley, and recreational developments in the upper watersheds.

Monterey Peninsula-Salinas Region

The implementation plan for the Monterey Peninsula-Salinas area calls for consolidation of Monterey Peninsula, Salinas, and Castroville area municipal wastewater flows with construction of a regional treatment plant and outfall facility for discharge to Central Monterey Bay with reuse of reclaimed wastewater for crop irrigation and possible enhancement of the lower Salinas River.

Staging can be accomplished in various ways; major elements of a staged program include:

1. Construct pumping station and interceptor sewer from Pacific Grove to the City of Monterey treatment plant during 1975. Enlarge and upgrade the Monterey facility to provide level II treatment during 1975 and abandon the existing Pacific Grove treatment plant. Discharge combined effluent flow through the existing Monterey outfall facility as an interim measure. Should reclamation be desired at Pacific Grove for such uses as golf course irrigation, a separate reclamation facility could be built for this purpose for treatment of wastewater flows diverted from the interceptor as demands for reclaimed water warrant.

2. Conduct further oceanography and marine biology studies during 1975 pertaining to a Central Monterey Bay outfall to be located somewhere near the mouth of the Salinas River.

3. Construct an interceptor sewer from Monterey through Seaside, Fort Ord, and Marina to a point near the Salinas River mouth consistent with the outfall alignment by 1977. Provide for local reclamation as justified by local needs.

4. Construct interceptor sewer from Salinas to the Monterey Bay shore consistent with the outfall alignment by 1977. Provide for local reclamation as justified by local needs.

5. Construct outfall into Central Monterey Bay from a point near the mouth of the Salinas River by 1977; outfall size should be sufficient to transport future wastewater flows from the Monterey Peninsula, Salinas and Castroville areas.

6. Convey wastewater effluents from the Monterey Peninsula treatment plants in the interceptor for outfall discharge to Central Monterey Bay by 1977; convey wastewater effluents from the Salinas Municipal treatment plants to the outfall by 1977; consolidated flows are required to meet level II treatment standards. At present flows, this would eliminate about 10 mgd from five local outfall discharges to the south pocket of Monterey Bay and 6 mgd from direct discharges to the Salinas River.

7. Construct interceptor from Castroville to the outfall location after existing unsewered areas in the Castroville area, including Moss Landing, Oak Hills and Prunedale, are sewered. These unsewered areas should develop sewering programs consistent with future consolidation with Castroville and the Monterey Peninsula-Salinas plan; these sewerage programs should be identified in terms of sewerage feasibility reports by 1977.

8. Construct a regional wastewater treatment and /or reclamation facility to permit abandonment of existing municipal treatment plants; reclamation plant construction consistent with level VI treatment would be initiated in the first stage of the regional wastewater treatment facility construction if reclaimed water demand is established; otherwise regional facility construction should be limited to level II treatment processes with provision for future upgrading. Irrigation reuse on local crops may require level III or level IV treatment and demonstrations of such reuse should be initiated prior to 1977 to determine extent of acceptance in the local farming community and evaluate public health aspects of this program. Begin construction of regional treatment plant by 1977.

Options are available in the program concerning the sequence of events and extent of consolidation to be achieved during the planning period; i.e., until the year 2000. For example, the timing for construction of interceptor sewers from the Monterey Peninsula or Salinas could be different; either can proceed first or construction can be concurrent. However, construction of the outfall must proceed with the first interceptor project, and the sizing of the outfall must be consistent with total future consolidation. In the Castroville area there are unsewered areas which may be sewered in the future; these facilities should be planned in harmony with the consolidation program. Sewerage feasibility studies should be performed to define more closely the staging of sewering of these areas and to relate sewer projects to future facility alignments. For example, Moss Landing should convey wastewaters southward for interim disposal to land or proceed directly toward consolidation with Castroville. Castroville may delay consolidation with Monterey-Salinas while sewerage facilities are being developed for areas to the north and east; however, land disposal is recommended for the Castroville area as an interim measure and for possible demonstration of irrigation reuse potential and to determine acceptance of such reuse to local farmers in this area. Elimination of discharge to Templedero Slough should be accomplished by 1976.

In the Salinas area the Gabilan Acres-Bolsa Knolls area should be tied in with the City of Salinas system, and the Toro Park plant should be abandoned by 1977 and wastewaters from this area should be conveyed to Salinas. A further consideration for Salinas is the possible retention of the industrial treatment facility which would avoid sizing interceptors for seasonal peak flows from seasonal wastes generated by processors of agricultural crops; long-term retention of the industrial waste facility should be evaluated at the project report level in terms of cost-effective aspects as well as impact on reclamation, both locally and on the reclamation features of the consolidation plan. Mineral quality and the timing of peak industrial flows which coincide with harvest periods may be incompatible with reclamation for irrigation reuse near Castroville. Although this facility could be retained, the discharge of industrial wastes to the regional interceptor system during peak periods could be accommodated.

In the Monterey area, the existing Monterey Peninsula Water Pollution Control Agency (MPWPCA) or a newly formed sanitation district could include Castroville CSD, Marina CWD, the City of Monterey, the City of Pacific Grove, Seaside CSD, and the City of Salinas as participating agencies. It is recommended that the tri-cities group (Monterey, Seaside and Pacific Grove) get together with Fort Ord, Marina, Salinas, and Castroville to decide on the character of the implementing agency and establish working arrangements for early aspects in the staging of the implementation plan, such as ocean outfall studies and irrigation reuse demonstrations. Joint powers agreements could be used initially; however, a management agency is envisioned which would have broader financing powers.

Salinas Valley Region

Implementation plans for the Salinas Valley communities and recreational areas in the upper watershed generally involve separate wastewater treatment and disposal facilities.

The small dischargers (less than 0.5 mgd) along the Salinas River, such as Chualar, Gonzales, Soledad, Greenfield, and San Miguel, are to remain on separate treatment facilities with disposal to land by percolation with seasonal irrigation reuse. The State Correctional Facility at Soledad (0.5 mgd) should continue this same practice. Treatment in these small communities could be accomplished with oxidation pond systems where year-round land disposal is assured; costs in Table 5-4, developed in the AMBAG plan for this area, inlcude costs for conventional secondary treatment; these costs can be reduced through continued reliance on oxidation ponds so long as no direct stream discharge is involved.

A sewerage feasibility study should be completed by mid-1976 for the Shandon area, including septic tank management considerations.

Implementation plans for the larger communities of King City, Paso Robles (2 mgd) and Atascadero each involve some degree of consolidation. The King City municipal plant should provide treatment and land disposal for wastewaters from the King City Airport; the new King City industrial treatment and land disposal facility should be retained.

The Paso Robles secondary treatment plant should be expanded to serve the Templeton Sanitary District area and an interceptor should be built to convey wastewaters to Paso Robles. Timing should be consistent with the sewering of the Templeton area. Wastewater disposal from the Paso Robles facility should be accomplished by land disposal.

The Atascadero County Sanitation District disposal facility should be expanded to accommodate flows from the Atascadero State Hospital; however, the priority for this consolidation is low in view of improvements at the hospital facility.

The Nacimiento Reservoir area plan calls for the maintenance of individual treatment and disposal facilities; new secondary treatment plants should be constructed at San Antonio Reservoir on both the north and south side and at Nacimiento Reservoir at two locations. These facilities will provide for land disposal by percolation with irrigation during the dry season. Recommended facilities should provide adequate protection of water quality in the Nacimiento area throughout the planning period.

The cities of King City, Greenfield, Soledad, Gonzales, and Paso Robles and the Chualar CSD, San Luis Obispo CSA 16 and San Miguel SD will provide their own wastewater services since they are all separated from any other agencies by significant distances.

Atascadero CSD should consider a contract with the State of California to provide transportation, treatment, and disposal for Atascadero State Hospital.

Carmel River Sub-Basin

The Carmel River Sub-basin includes the Carmel Sanitary District, sewered areas of the Carmel Highlands and extensive unsewered areas, particularly within Carmel Valley.

The existing Carmel Sanitary District treatment plant and outfall facility should be retained to provide for water quality control until reliable land disposal or reclamation programs are developed in Carmel Valley. Level II treatment is required for ocean disposal. The existing outfall can accommodate wet weather flow discharges during times when reclamation is not feasible. A special study by the District is under way to determine the adequacy of the existing outfall with respect to State Ocean Plan requirements. The results of this study will outline what changes, if any, are required for the existing outfall. Carmel Highlands wastewaters should be transported to the present Carmel Sanitary District plant for treatment. Comprehensive studies to determine the feasibility of establishing separate treatment plants should be completed by mid-1976 for the Carmel Valley area; these studies should include consideration of septic tank maintenance and feasibility of land disposal and wastewater reclamation for areas sewered. It will be important to make sure these land disposal facilities are operated in conjunction with groundwater basin operations. Irrigation possibilities exist for the upper and mid-valley locations. Land disposal in the lower valley might best be directed toward protecting the groundwater basin from seawater intrusion. More detailed studies of groundwater and land disposal are needed prior to shifting the existing discharge to Carmel Bay to land disposal in the lower valley. Accordingly, the continual use of ocean disposal is allowable as an option year round and should be maintained for wet season disposal. In the event a higher level of treatment than secondary is required, the plan for the region should involve collection of treated effluent from the Carmel Valley. Effluent would be transported to the upper valley. An advanced treatment facility would be constructed at the Carmel SD facility to reclaim waters for transport inland. The reclaimed water would be used either for groundwater recharge or for supplementing supplies developed on the Carmel River.

Carmel SD will continue its present joint exercise of powers agreement to treat and dispose of wastes pumped from Pebble Beach SD. Carmel SD should manage wastewater facilities and programs in Carmel Valley and Carmel Highlands.

Monterey Coastal Sub-Basin

The only facility recommended for the Monterey Coastal Sub-basin is the construction of a land disposal system at Pfeiffer Big Sur State Park. Existing facilities at the Point Sur Naval Facility are adequate to meet the water quality control requirements of that discharge.

San Luis Obispo Coastal Sub-Basin

Municipal wastewater management plans for the San Luis Obispo Coastal Sub-basin are described for each of four hydrographic regions including the North Coast Region, the Morro Bay Region, the San Luis Obispo Creek Region, and the South County Region.

North Coast Region

The strategy recommended for the North Coast region municipal dischargers calls for the maintenance of separate municipal treatment and disposal or reclamation facilities at San Simeon Acres Community Services District (.1 mgd) at Cambria County Water District (.2 mgd) and at the Cambria Air Force Radar Station.

Feasibility level studies indicate that land disposal of treated wastewater will definitely be the most suitable means of disposal for the Cambria Air Force Radar Station. Land disposal utilizing percolation basins is probably the most cost-effective disposal option for San Simeon Acres and Cambria. Ocean disposal is an acceptable option; however, reclamation should be encouraged in this water-short area. As these are small dischargers, in each case level II treatment is recommended. Wastewater from the Air Force Station Dependent Housing area south of Cambria should be conveyed to Cambria by 1976. Land disposal in areas underlain by groundwaters which may be used as a domestic water supply will require a detailed program of groundwater quality monitoring. Such a monitoring program would indicate if and when nitrogen removal and total dissolved solids (TDS) control will be necessary. An excellent potential for wastewater reuse for golf course irrigation exists in the Cambria area and should be the subject of project level studies. Such a program would be subject to the standards for the use of reclaimed water contained in Title 17 of the California Administrative Code. Use of wastewater irrigation is encouraged to reduce need for groundwater pumping; this will assist in maintaining water balance in this area. See Chapter 6 for additional comments on water balance.

The present sewerage agencies at San Simeon Acres, Cambria County Water District, and the Air Force Station should implement needed improvements. Service from the Hearst Castle and State Beach should be accomplished by service contract arrangements with San Simeon Acres. Financial hardship can be demonstrated by San Simeon Acres where a tax rate of over $5 per $100 AV is indicated, with over $900 per connection per year; relief is needed for this District. See Chapter 16 for discussion of possible approaches to resolve this hardship. Cambria CWD should make service contract arrangements with the Air Force Dependent Housing area.

Morro Region

Feasibility level studies conducted by the City of Morro Bay indicate that the City, which also treats and disposes of wastewater from the Cayucos Sanitary District, should dispose of its treated wastewater on land. The City of Morro Bay in the Technical Report on its Ocean Discharge has proposed that effluent from the existing secondary treatment facilities will be filtered, chlorinated and conveyed to several points in Chorro Creek Basin for reuse and land disposal. Such disposal is compatible with the water balance of this area. Utilizing this concept, the existing ocean will be abandoned and storage provided for those periods when land disposal is not possible. Secondary treatment, originally recommended by the City, is considered adequate if irrigation techniques are used to maximize vegetative uptake of nitrogen. However using percolation disposal level V treatment (nitrate removal) will be necessary and the City should monitor the quality of groundwaters which underlie the land disposal areas to insure that effluent disposal operations do not increase groundwater TDS concentrations in the usable groundwater basin. Runoff from land disposal areas during wastewater application will not be allowed. If land disposal is found to be infeasible at the project level, retention of the ocean disposal method is acceptable. Morro Bay facility improvements described above should be resolved at the Project Report level in 1974 and construction should be completed by 1976.

It is recommended that the California Men's Colony upgrade its level of wastewater treatment by 1977 to level V (biological nitrification-denitrification with disinfection) and dispose of treated wastewater by percolation on the land. Use of irrigation techniques to maximize vegetative uptake of nitrogen should be encouraged at the California Polytechnic State University. This method may indicate level II treatment would be cost-effective. Stream discharge alternatives are not recommended; this would require costly level VI treatment unless it can be shown that such discharge will not degrade Morro Bay. Flood protection of the plant site will be needed. Runoff from land disposal areas during wastewater application will not be allowed.

All municipal wastewater disposal operations in the region should be components of a wastewater reclamation and reuse program. Project level studies of wastewater reuse for golf course irrigation, for the prevention of salt water intrusion and for agriculture should be conducted. It is recommended that a thorough evaluation of wet weather infiltration and direct storm inflow to the Cayucos Sanitary District, City of Morro Bay and California Men's Colony sewerage systems be conducted in order to determine what steps will be necessary to reduce wet weather inflow to an acceptable value.

In the Los Osos-Baywood area, it is recommended that a sewerage feasibility study be initiated to evaluate groundwater quality and public health considerations as affected by septic tank systems and to determine feasibility for sewering all or a portion of this area. See discussion of individual disposal systems. Septic tank maintenance approaches should also be considered where sewers are not recommended. These technical studies should be completed before mid-1976. When it becomes necessary to sewer all or a part of the community, treated wastewaters should be disposed on land within an area of recharge of a local groundwater basin after appropriate treatment. Disposal sites can be located over poorer groundwater; see Chapter 6. Disposal of municipal wastewater by percolation to groundwater used for public water supply will require nitrogen removal (level V treatment). Disposal to more remote lands, use of irrigation techniques, or repulsion of seawater intrusion may be conducted following level II treatment; justification for level II treatment should be provided in project level studies.

The City of Morro Bay already treats and disposes wastewater from Cayucos Sanitary District and should continue this arrangement with modifications of the existing agreement which allows for the addition of recommended facilities. The Los Osos-Baywood area should include septic tank management function in their sewerage agency.

San Luis Obispo Creek Region

It is recommended that the City of San Luis Obispo (4 mgd) and Avila Beach County Water District (0.2 mgd) continue to operate separate municipal wastewater treatment and disposal facilities. The wastewater treatment plant of the City of San Luis Obispo will serve as a regional treatment plant for San Luis Obispo CSA 18 and surrounding unincorporated county areas which will sewer when necessary and connect to the City.

Discharge to San Luis Obispo Creek from the City of San Luis Obispo's treatment plant should cease during periods of low flow unless non-degradation of this stream can be assured. It is recommended that the City of San Luis Obispo stage upgrading of its wastewater treatment plant to provide level VI treatment (including nutrient removal effluent filtration, disinfection to an MPN of 2.2 per 100 ml and dechlorination); a less acceptable option is to cease dry season discharge and retain wastewaters on land by 1977. Wastewater disposal accomplished by direct discharge to San Luis Obispo Creek will require a strict salt source control program and may also require partial demineralization. It may be possible to delay the construction of nutrient removal, effluent filtration or demineralization facilities if project level studies show that nonpoint waste discharge of nutrients, bacterial contaminants or salts to San Luis Obispo Creek would negate the benefit of such facilities. Receiving water studies including waste loads from non point sources and stream ecology assessments should begin as soon as possible; see discussion in Chapter 15.

The city's wastewater treatment and disposal operations should be components of a wastewater reclamation and reuse program. Excellent opportunities exist for the use of reclaimed municipal wastewater golf course and park irrigation, maintaining a constant water level in Laguna Lake, and flushing or diluting nutrients from non-point sources. Use of these or similar programs is encouraged in order to avoid direct discharge to the creek. Overflow from Laguna Lake could provide stream enhancement benefits if level VI treatment is provided. Project level studies will be necessary to determine the feasibility of such reuse programs.

It is recommended that a thorough evaluation of wet weather infiltration and direct storm inflow to the city and California Polytechnic State University sewerage systems be conducted in order to determine what steps will be necessary to reduce wet weather inflow to an acceptable value. An analysis of current wet weather flows to the wastewater treatment plant has indicated that infiltration and direct storm inflow contribute two to three times as much flow as should be expected with a well-constructed and maintained sewerage system. During wet weather periods, raw wastewater has bypassed the treatment plant and discharged to San Luis Obispo Creek; however, in recent years, some of this flow is directed to a pond for chlorination prior to discharge. The plant site is also subject to being flooded during periods of high runoff in San Luis Obispo Creek, and this should be corrected.

The Avila Beach County Water District is required to upgrade its wastewater treatment plant to secondary treatment by 1977 to comply with the EPA effluent qualty requirements. In addition, it may be necessary to lengthen the outfall and add a multiport diffuser in order to comply with the initial dilution requirements of the State Ocean Plan.

Staging of improvements is encouraged in view of financial hardship which would result from early implementation of the plan and the lack of evidence concerning effects of this small discharge on local ocean waters. Studies should be conducted to determine if outfall extension is really necessary; consideration of an intermediate treatment upgrading physical chemical treatment is recommended; this would be possible at the small existing plant site. An excellent opportunity for wastewater reuse for golf course irrigation exists in the Avila area which should be the subject of project level studies. Should the City of San Luis Obispo reduce discharges upstream, Avila wastewaters could be diverted to local golf course irrigation since waters available to the present golf course irrigation supply at Avila Beach would be reduced. An analysis of wet weather inflow to the sewerage system should also be conducted. Implementation should continue to be accomplished by the City of San Luis Obispo and the Avila Sanitary District; problems are associated with the plan for Avila Beach due to financial hardship as a tax rate of over $11 per $100 assessed value and annual cost of nearly $500 per connection is indicated. Possible solutions for projects with financial problems are discussed in Chapter 16.

South County Region

The implementation plan for the City of Pismo Beach and for the South San Luis Obispo County Sanitation District consists of minor wastewater treatment plant upgrading (level II treatment) with either separate or joint ocean disposal to be completed by 1977. The combined flow is about 2.5 mgd at present. Future enlargements should provide duplicate process units needed for improved maintenance. Project level studies of the condition of the existing ocean outfalls, local oceanographic conditions, the character of the ocean floor, and marine biota in the vicinity of the outfalls, and beneficial uses and environmental sensitivity of the receiving waters will be necessary to determine discharge point for an extended Pismo Beach outfall and to repair or replace the damaged South County outfall. Consideration of a joint outfall to serve both dischargers is recommended.

An evaluation of the wet weather inflow to each discharger's collection system should be conducted. The potential for wastewater reuse, particularly in the Arroyo Grande Valley, should be studied at the project level. Potential wastewater reuses include agriculture, golf course irrigation, streamflow augmentation, and groundwater recharge or to repel seawater intrusion.

It is recommended that the Lopez Recreation Area WTP be enlarged and upgraded to level II treatment and that land disposal be continued. Groundwater quality monitoring will be necessary to provide early warning of a threatened nitrate impairment in groundwaters downstream of the disposal area. Nitrogen removal may be necessary at some time in the future. Implementation of the plans for this region present no special problems and should be pursued by existing agencies.

Soda Lake Sub-Basin

There are no municipal sewerage systems in the Soda Lake sub-basin; recommended practices for individual disposal systems will pertain to this area.

Santa Maria River Sub-Basin

The municipal wastewater management plans for the Santa Maria River Sub-basin are described separately for the Santa Maria Valley and the Cuyama Valley Regions.

Santa Maria Valley Region

It is recommended that separate wastewater treatment and disposal facilities be maintained by the City of Guadalupe (0.5 mgd), by the City of Santa Maria (6.5 mgd), and by the Laguna County Sanitation District (1.3 mgd); in each case disposal will be to land. Disposal of wastewaters to the land in the Santa Maria Valley will require control of nitrogen and total dissolved solids (TDS); accordingly, level VII or VIII treatment is necessary. It is recommended that the strategy for TDS control be comprised of lime-sada softening of all municipal water supplies combined with a strict source control program. Removal of nitrogen from the wastewater utilizing biological nitrification and denitrification or a comparable process is recommended. Feasibility level studies indicate that the Santa Maria Public Airport (0.7 mgd) should convey its untreated wastewater either to the City of Santa Maria or the Laguna County Sanitation District Plant. Either is acceptable; consolidation should be accomplished by 1976.

Because the Santa Maria Valley groundwater basin is reported to be in a state of adverse salt balance, it is imperative that a systematic approach to evaluation of this problem be developed and that a mathematical model of this basin be developed and verified which can be used to predict the impact of the various waste discharges and practices on groundwater quality. Such a model should be used to indicate effects of changes in land use, agricultural practices, and point waste discharges that may be necessary to prevent water quality degradation and to protect beneficial uses of the groundwaters in the area. The study should quantify all the sources of salt to the groundwater basin and consider legal and institutional constraints.

In the Nipomo area, it is recommended that a sewerage feasibility study and a program of surveillance of septic tank system operation and of groundwater quality be completed by mid 1976. When it becomes necessary to sewer the community, treated wastewater should be disposed of on land. Secondary treatment (level II) will be necessary. A septic tank management district will be required to service unsewered areas. Implementation programs should be conducted by existing agencies.

The City of Santa Maria should establish a service contract agreement with the Santa Maria Airport, with the city acting as the management agency and the airport acting as a local contracting agency. The same kind of arrangement should be made between the Airport District and Laguna County SD.

The City of Guadalupe will experience a financial hardship due to the increased treatment required by the implementation plan; a tax rate of from $3 to $5 per $100 assessed value and an annual connection charge of from $250 to $300 is indicated; most of the added financial burden is due to addition of treatment to remove TDS from the effluent or for lime-soda softening of the water supply to prevent groundwater degradation. Remedial measures are discussed in Chapter 16.

Portions of the Nipomo Service area overlap the Nipomo Community Services District and San Luis Obispo County Service Area No. 1, neither of which presently provides wastewater services. The County Board of Supervisors, through the resolution and hearing process, can form a new county service area or expand the boundaries of CSA No. 1 to include all of the proposed service area. An acceptable alternative would be to expand Nipomo CSD, since it is already a larger region than CSD No. 1, and has an existing administrative structure. If the district's Board of Directors or constituents feel that it should assume this additional function and annex more territory, the only additional requirement for expansion is that an election be held. Use of a CSA is the recommendation in this case. Septic tank management functions should be included. Financial hardship is evident in the Nipomo area and implementation will depend on the extent of sewering and grant availability. Remedial measures are described in Chapter 16.

Cuyama Valley Region

It is recommended that either municipal water supplies be partially demineralized or that exploratory wells be drilled and a higher quality water supply secured if possible. Effluent from the wastewater treatment plant operated by Cuyama Valley Community Services, Incorporated, should be disposed to land, preferrably by percolation. A strict salt source control program will also be necessary. Level II treatment is recommended for this small discharge (0.3 mgd).

New Cuyama, which is also served by an investor-owned utility, Cuyama Valley Community Services, Inc., will require a CSA in order to obtain state and federal grants.

San Antonio Creek Sub-Basin

There are no municipal wastewater treatment facilities in this sub-basin. Individual wastewater disposal systems prevail in this sub-basin; recommendations concerning these systems are described elsewhere in this chapter. Disposal of ion exchange residues from a water supply facility operated by Vandenberg Air Force Base does occur through land disposal over poor quality groundwaters; see Chapter 16.

San Ynez River Sub-Basin

Municipal wastewater management plans for the Santa Ynez River Sub-basin are described separately for the Lompoc Valley and the Upper Santa Ynez Regions.

Lompoc Valley Region

It is recommended that Vandenberg Air Force Base (3 mgd) and the City of Lompoc (1.8 mgd) continue to operate separate municipal wastewater treatment and disposal facilities. The City of Lompoc treatment plant will be expanded to serve as a regional wastewater treatment faciltity for the Lompoc Valley.

It is recommended that the main wastewater treatment plant serving the northern portions of Vandenberg Air Force Base be upgraded to level II treatment as required for ocean disposal. Feasibility level studies indicate that chlorine contact and dechlorination facilities and either a duplication of some process units or the construction of storage facilities are necessary. The existing ocean outfall has been abandoned; it will be necessary to reconstruct a longer outfall to comply with the initial dilution requirements of the State Ocean Plan or provide for land disposal. A project level investigation of the wet weather inflow to the base collection system should be conducted and a program initiated to reduce such inflow.

It is recommended that the raw wastewater lagoon serving south Vandenberg Air Force Base be retained. Disposal of treated wastewaters by percolation will be continued and discharges to surface waters during wet weather will be eliminated.

It is recommended that untreated wastewaters from the Federal Correctional Institution (FCI), (0.3 mgd), Vandenberg Disposal Company, and from Lompoc Utility Services be conveyed to the City of Lompoc wastewater treatment plant. Disposal to the Santa Ynez River will continue. The City of Lompoc wastewater treatment plant will be enlarged and upgraded to treatment level III, consisting of biological oxidation with nitrification and disinfection. Control of wastewater TDS should consist of municipal lime-soda softening coupled with a recommended strict source control program to control water softener brines. It is recommended that the city also investigate alternative local water supply sources such as a deep well in Lompoc Valley groundwater basin in order to improve the quality of water supplied to the service area; the city should also consider diluting wastewater prior to percolation and other water conservation projects.

Project level studies have indicated that the use of reclaimed water in a planned groundwater recharge program should be a part of the plan for the Lompoc Valley. Current plans do not include filtration of the effluent of the City of Lompoc WTP. However, it is recommended that the effluent and the groundwater quality in the vicinity of the discharge areas be monitored to indicate if and when effluent filtration, nitrogen removal or increased TDS control will be necessary.

Feasibility level studies indicate that it would be cost-effective for the Federal Correctional Institution (FCI) to join the City of Lompoc system and that this be done before the system is constructed. It is recommended that FCI join the regional system.

Because the Lompoc Valley groundwater basin is reportedly in a state of adverse salt balance, it is imperative that a groundwater quality model be developed and verified which can be used to predict that impact of the various waste discharges on groundwater quality. Such a model should be used to indicate these changes in land use, agricultural practices, and point waste discharges that will be necessary to protect the beneficial uses of the groundwaters in the area.

The City of Lompoc, acting as a management agency, should establish a joint powers agreement with the Federal Correctional Institution and two new county service areas, which will act as local contracting agencies. There are service contracts between the City of Lompoc and investor-owned utilities serving Vandenberg Village and Mission Hills. In order to obtain state and federal grants, it may be necessary for these areas to form county service areas. This is a matter which will require discussion between the firms now serving the area and the appropriate government agencies.

Upper Santa Ynez Region

It is recommended that enlarged upgraded wastewater treatment and disposal facilities be maintained at Buellton Community Services District (0.3 mgd), at Solvang Municipal Improvement District (0.3 mgd), and at the Cachuma County Sanitation District (0.2 mgd). Secondary treatment (level II) prior to land disposal coupled with a strict salt source control program will be necessary. It is recommended that the community of Santa Ynez implement a sewerage construction program. Sewered wastewaters from Santa Ynez should be conveyed to Solvang Municipal Improvement District for treatment and disposal. Areas where septic tank systems are acceptable should be identified and should be managed by a septic tank maintenance district. The Solvang MID percolation basins and a major interceptor sewer are located in a flood-prone area; it is recommended that sufficient disinfection capacity be available to disinfect the effluent during flood periods. Project level studies of wastewater reuse for landscape and agricultural irrigation should be initiated for this area.

Santa Barbara Coastal Sub-Basin

It is recommended that separate municipal wastewater treatment and disposal facilities be maintained by Goleta Sanitary District, the City of Santa Barbara, Montecito Sanitary District, and the Carpinteria Sanitary District. The Summerland Sanitary District treatment plant should be retained until 1980; future more detailed study at the project level of the alternatives available to Summerland will be necessary to determine whether or not the flow from that discharger should eventually be conveyed to the Montecito Sanitary District for treatment. Unsewered state park facilities at Gaviota and adjacent community areas should be evaluated for sewerage feasibility.

Feasibility level studies indicate that the Goleta Sanitary District wastewater treatment plant, which also serves the Isla Vista Sanitary District, the University of California at Santa Barbara, and the Santa Barbara Public Airport, should continue disposing of its effluent to the Pacific Ocean through an ocean outfall with a multiport diffuser. Present flow is about 6 mgd. It is recommended that the Goleta Sanitary District treatment plant be upgraded to provide secondary biological treatment (level II); however, primary sedimentation with chemical addition, disinfection and dechlorination (level I) may be a possible future option which will meet the requirements of the State Ocean Plan. See discussion of ocean disposal.

Ocean disposal preceded by biological secondary treatment, disinfection and dechlorination (level II) is recommended for all of the municipal dischargers. For Summerland Sanitary District (0.1 mgd), project level studies may show that local reclamation of conveyance of untreated wastewater to Montecito Sanitary District (0.7 mgd) is a suitable course of action; meanwhile, reliance on the present ocean outfall for disposal is acceptable. Santa Barbara discharges about 8 mgd; upgraded expanded facilities to 11 mgd have been designed.

Because the Santa Barbara sub-basin is a water-short area, wastewater reclamation and reuse programs proven cost-effective at the project level should become a component of the plan. This option is not now available but may be found feasible in the future. Dischargers are encouraged to investigate and implement plans for wastewater reclamation and reuse. Coordination with agricultural interests is encouraged as there are demands for irrigation water, particularly in the western part of the sub-basin. Centralized line-soda softening of municipal water supplies and strict salt source control programs would improve potential for wastewater reuse. The landscape irrigation wastewater reuse program proposed by the Montecito Sanitary District, which has been proven cost-effective at the project level, should be a component of the plan.

It is also recommended that wet weather inflow to the following sewerage systems be analyzed at the project level: Isla Vista Sanitary District, Santa Barbara Public Airport, University of California at Santa Barbara, Goleta Sanitary District, City of Santa Barbara, Summerland Sanitary District and Carpinteria Sanitary District.

The Goleta Sanitary District, which presently serves Isla Vista Sanitary District, the University of California at Santa Barbara, Santa Barbara Airport, and part of the City of Santa Barbara, should modify existing agreements to reflect costs of the recommended project and to assure that the operating entity is empowered to implement the plan.

The Summerland Sanitary District would be burdened with financial hardship as a result of the plan; a tax rate of $2.50 per $100 and an annual cost per connection of nearly $350 is indicated. Remedies are discussed in Chapter 16.

INDUSTRIAL WASTEWATER MANAGEMENT

In Chapter 16 alternative industrial wastewater management plans were investigated. Those project level studies necessary to insure compliance with the water quality objectives presented in Chapter 4 were recommended.

In general the alternatives available to industrial discharges are the following: (1) abandonment of the facility; (2) ocean discharge and compliance with the State Ocean Plan, the State Thermal Plan and Public Law 92-500; (3) containment of non-saline and non-toxic wastes on land and (4) reinjection of oil and gas production brines. In most cases, alternatives will be limited by standards of performance and pretreatment standards being developed by EPA. It should also be noted that Federal guidelines will be subject to regional considerations such as important fishery resources or wildlife areas which could necessitate making regional industrial discharge requirements more stringent than national performance standards. It is recommended that the RWQCB establish a timetable for either compliance with the water quality objectives of the plan or cessation of the discharge of industrial wastewater.

Specific effluent limitations are being promulgated for existing industrial waste discharges together with standards of performance and pretreatment standards for new sources pursuant to Sections 304 (b), 306 (b), and 307 (b) of the Federal Water Pollution Control Act. Effluent limitations were being circulated for comment by the EPA. Waste source categories of particular interest in the basin which will be covered by those sections of the Federal Law include:

Meat product and rendering processing

Dairy product processing

Canned and preserved fruits and vegetables processing

Canned and preserved seafood processing

Cement manufacturing

Feedlots

Electroplating

Beet sugar processing

Petroleum production and refining

Steam electric powerplants

Leather tanning and finishing

As procedures for establishing these guidelines and performance standards have been issued only to a minor segment of industry by the EPA, it appears inappropriate to attempt to anticipate regulations for these industrial discharge categories except to the extent discussed in Chapter 16. Other industries will be covered in the NPDES program.

SOLID WASTE MANAGEMENT

The protection of water resources requires consideration of solid waste management practices. This section discusses present and future solid waste production, existing disposal practices and their effect on water quality, and proposed plans for future solid waste dispsoal within the study area. Solid wastes include (1) domestic waste—refuse, demolition wastes, sewage treatment plant sludge; (2) industrial wastes—special wastes which are a source of toxicity, mineralization, taste and odors (including semi-solid sludges and slurries); and (3) agricultural wastes—nutrient sources (manures), pesticides and pesticide containers.

In the AMBAG area there are 45 authorized waste disposal sites most of which are sanitary landfill operations. These facilities are described in Chapter 16. There are two Class I sites within the AMBAG area. One Class I site is the Hollister, San Benito County site; however, this site only handles toxic wastes from San Benito County. The other is a modified Class I site near San Ardo which accepts only oil field wastes. Accordingly, toxic wastes are exported elsewhere or are placed in Class II sites within the AMBAG area in violation of regulations. Water quality problems related to waste disposal have been identified at nine sites and potential problems have been noted at four others.

The only existing solid waste management plan in the AMBAG area covers the Salinas Valley of Monterey County; however, a plan is being prepared for Santa Cruz County. The Salinas Valley plan recommends elimination of nine of ten existing disposal sites with consolidation of disposal activities at the existing Soledad site and development of a new site mid-way between Greenfield and King City. Implementation of this plan is recommended. Other areas within AMBAG should develop plans for solid waste management as required by State law and to comply with state requirements regulating waste disposal to land. County solid waste management plans may ultimately implement waste processing, reclamation, and recovery operations.

Projected solid waste loadings indicate the need for additional landfill areas in the southern portion of the basin. Some of the sites in the basin are no longer active; these include the Santa Maria Airport and Guadalupe sites. Solid waste disposal information available for Santa Barbara

County emphasized three landfills will be utilized for future refuse disposal including a proposed 20-acre landfill in the Ventucopa area near Highway 33 in the Cuyama Valley, the Tajiguas Canyon site in the South Coastal Area and the Foxen Canyon site in the upper Santa Ynzez Valley.

Institutional arrangements for solid waste management are also discussed in the next section. Waste collection operations are both public and private and disposal sites are operated by various entities in Santa Barbara County. There are no Class I dump sites in San Luis Obispo County, so Class I waste materials must be hauled south to Tasmalia. Solid waste management planning should be given a high priority in San Luis Obispo County consistent with State Water Resources Control Board policies and in compliance with applicable State Department of Health regulations. Administrative controls are needed at the county government level.

More information is needed on solid waste sites to permit more effective management. No systematic monitoring program is currently carried out to determine the effect of solid waste disposal sites on the quality of surface and groundwaters in the study area. It is recommended that specific provisions for carrying out monitoring programs be included in the discharge requirements for solid waste disposal operations. An adequate monitoring program should include collection of surface and groundwater samples upstream, adjacent or under, and downstream from sanitary landfills where appropriate. Monitoring Programs should be interfaced with requirements of the State Solid Waste Management Board.

Complete mineral analysis of surface and groundwater samples including determination of trace metals should be incorporated in the monitoring program. Bacteriological evaluation should be carried out for determination of coliform concentrations around all Class I and Class II disposal sites. Concentration of organic compounds, specifically those contained in the chemicals used for pest control purposes, should be determined in water samples obtained from areas adjacent to all Class I landfills.

It is recommended that discharge requirements, consistent with state policy, be established for all existing and proposed future land disposal sites in the basin.

NON-POINT SOURCE MEASURES

Wastewaters orignating from non-point sources include those from agricultural activies, urban runoff, erosion from construction, mining or logging operations, vessels and individual waste disposal systems. Waste loadings have been quantified for these kinds of activities; see Chapter 15.

Control on non-point wastewaters falls into several categories including 1) changes in practices to minimize waste emission; 2) prohibition of polluting activities; or 3) some form of treatment program. For example, to minimize waste emissions, agricultural irrigation practices can be modified to lessen salt buildup rates in groundwater and there are ways to control drainage from dairies and feedlots to minimize contamination of of surface waters. Prohibition may be effectively used to eliminate vessel waste discharges and individual disposal systems in areas where such practices cause water degradation. Treatment approaches can be applied to all of the above examples and to collected urban drainage; use of buffer strips along water courses can be effective in controlling effects of erosion from logging or construction activities.

Effluent limits and facility requirements are not readily applicable to most non-point wastewater sources. Most controls are accomplished through upgraded practices or by prohibition of polluting activities. Topical discussions of significant non-point source measures applicable to the Central Coastal Basin are provided for urban runoff management, agricultural wastewater management, individual waste disposal practices and construction and logging activities.

Urban Runoff Management

The effect of urban runoff on receiving water quality is a problem which has only recently come to be recognized. Most of the work up to the present has centered on characterizing urban runoff: concentrations of various constituents have been measured, attempts to relate these to such factors as land use type and rainfall intensity have been made, and studies concerning the amounts of these constituents present on street surfaces have been conducted. It appears that considerable quantities of contaminants, heavy metals in particular, may enter the receiving waters through urban runoff. The federal Water Pollution Control Act Amendments of 1972 stress future "control of treatment of all point and non-point sources of pollution." Thus the federal government has concluded that nonpoint sources, such as urban runoff, are indeed deleterious to the aquatic environment and that measures should be taken to control such emissions. The following discussion is presented in accordance with this view.

There are four basic approaches to controlling pollution from urban runoff: (1) prevent contaminants from reaching urban land surfaces; (2) improve street cleaning and cleaning of other areas where contaminants may be present; (3) treat runoff prior to discharge to receiving waters, and (4) controls of land use and development. Which approach or combination of approaches is most effective or economical has not yet been studied extensively. Thus only the basic characteristics of each approach can be discussed. In addition to these direct approaches, measures to reduce the volume of runoff from urban areas are also available.

Source controls

The first approach, which emphasizes source control, has many aspects. Tough, effective air pollution laws can probably aid in reducing the amounts of certain materials deposited on the land. An obvious example is lead in automobile exhaust emissions. In order to meet future federal emission standards, automobile manufacturers will probably utilize a "catalytic converter" which requires nonleaded gasoline. Thus, the production of leaded gas will probably decrease in the future, cutting down the supply of lead which can be washed into receiving waters. Effective anti-litter ordinances and campaigns can aid in reducing floatable materials washed to surface waters. These materials are objectionable primarily from an aesthetics viewpoint. New construction techniques may reduce emissions to receiving waters. Erosion can be decreased by seeding, sodding, or matting excavated areas as quickly as practicable. Construction in certain critical areas can be limited to the dry season. Stockpiling of excavated material can be regulated to minimize erosion. Control of chlorinated hydrocarbon pesticide usage would reduce the amounts found on urban land surfaces and thus reduce the amounts washed to natural waters.

Street Cleaning

The second approach to reducing pollution from urban runoff involves improving street cleaning techniques. Generally, street cleaning as presently practiced is intended to remove large pieces of litter which are aesthetically objectionable. The removal of fine material which may account for most of the important contaminants is minimal. It may be possible to design mechanical sweepers to remove a greater fraction of the fine material. Alternatively, vacuum-type street cleaners could be developed to produce better results.

In addition to streets, sidewalks and roofs contribute large amounts of runoff. Controlling contaminants present on these surfaces would be more difficult and would be up to individuals. Advertising campaigns would probably be unproductive and legislation would be unworkable except perhaps in specific, localized situations. Therefore, contaminant removal will probably be limited to street surfaces.

In many areas streets are cleaned by flushing with water from a tank truck. If catch basins are present, this material may be trapped in them. If catch basins do not exist, the material will be simply washed to the sewers where subsequent rainfall will carry them to surface waters. Where catch basins are regularly cleaned out, they can be effective in removing materials during runoff. Where they are allowed to fill up with material, they add to the pollution loading during a storm by discharging septic material. In any case catch basins usually exist in older urban areas and have a rather low efficiency in removing contaminants from stormwater.

Treatment

The third approach to reducing the effects of urban runoff on receiving water quality involves collecting and treating the runoff. Physical or physical-chemical treatment would be required; the intermittent nature of storm flows precludes biological treatment. Examples of possible treatment processes are simple sedimentation, sedimentation with chemical clarification, and dissolved air flotation. A principal problem with this approach is collection. Present storm sewerage systems generally drain to open creeks and rivers directly to tidal waters. Even if treatment facilities were located at various sites in the Basin, a massive collection system would have to be built. The economic question of "treatment vs. transport" would have to be studied with specific regard to stormwater runoff. Local sewage treatment plants abandoned in favor of regional facilities could possibly be utilized in such a program. One method of cutting down the peak flow capacity required is to provide storage volume in the collection system. Solutions to the problem of preventing water quality degradation by urban runoff are only in the earliest stages of development and consist mostly of plausible hypothesis on how to deal with the problem. Therefore, it is not possible at this time to present a definite plan with regard to this subject. It is probable that research and study which up to now has emphasized defining and characterizing the problem, will turn to developing methods of control. The Federal Water Pollution Control Act Amendments of 1972 state specifically that the EPA is authorized to conduct and assist studies "which will demonstrate a new or improved method of preventing, reducing, and eliminating the discharge into any waters of pollutants from sewers which carry storm water . . ." It is probable that during the next few years considerable progress will be made. It is recommended that information be collected and studied so that a workable plan can be implemented in the future.

Control of Urbanization

A fourth approach is to encourage controls on urbanization which will either reduce the volume of runoff or at least not cause runoff to increase as a result of urban growth. The usual pattern is that increased urbanization leads to higher runoff coefficients, reflecting the many imprevious surfaces associated with development. Roof drains to storm sewers, paved parking lots and streets, installation of storm sewers, filling of natural recharge areas, and increased efficiency in realigned and resurfaced stream channels all are characteristics of urban growth. Development near streams and on steep slopes is deleterious to water resources; it is less disruptive to develop the lower portions of a watershed than the headwater areas, both from the standpoint of the length of channel affected and the extent of channel enlargement necessary to convey stormwater. Use of porous pavements and less reliance on roof connections to storm drains and more emphasis on local recharge would reduce the peak volume of runoff from storms. Areal mass emissions of urban drainage constituents should be quantified. Urban planning should be more cognizant of land constraints to permit greater natural recharge where possible and feasible and to discourage intensive development of steep land particularly in headwater areas.

Agricultural Water and Wastewater Management

Agricultural wastewaters and the effect of agricultural operations are a result of land use practices; controls should ultimately be developed from land use plans. This aspect of nonpoint source control is discussed in Chapter 16. Controls are also required to minimize adverse effects from agricultural practices. The following discussion is confined to recommended improvements in practices and to the scope of federal-state permit programs which will regulate certain agricultural activities. The discussion of practices is limited here to animal confinement and irrigation practices. This plan presents animal confinements as dispersed non-point sources. Pesticide use and limits on fertilizer applications are not specifically considered here; these materials are covered by appropriate water quality objectives.

Federal-State Permits Governing Agricultural Operation

Dischargers of wastes to waters of the state are managed in part by the permit program. Any person proposing to discharge waste that could affect the quality of the waters of the State must file a report of discharge with the appropriate Regional Board. The Board will prescribe discharge requirement. The requirements implement the water quality control plans and take into consideration the beneficial uses to be protected.

The 1972 Amendments to Public Law 92-500 directed the Environmental Protection Agency to set up a permit system for all dischargers. Agriculture is specifically considered and permits are required for:

1. Feed lots with 1,000 or more slaughter steers and heifers.

2. Dairies with 700 head or more, including milkers, pregnant heifers, and dry mature cows, but not calves.

3. Swine facilities with 2,500 or more 55 pound swine.

4. Sheep feedlots with 10,000 head or more.

5. Turkey lots with 55,000 birds unless the facilities are covered and dry.

6. Laying hens and broilers, with continuous flow watering and 100,000 or more birds.

7. Laying hens and broilers with liquid manure handling systems and 30,000 or more birds.

8. Irrigation return flow from 3,000 or more acres of land when conveyed to navigable waters from one or more point sources.

The law also provides that the state may administer its own permit program if EPA determines such program is adequate to carry out the objective of the Law. On March 26, 1973 this authority was transfered from the EPA to the state of California for waters within the State. Thus, the Regional Board will be issuing discharge requirements to the agricultural operations covered under the aforementioned guidelines. The state, may require discharge permits from any discharger, regardless of size.

Animal Confinement Operations

Animal confinements such as feedlots and dairy corrals present a surface runoff problem during wet winter flows. Runoff water passes through hillside operations to sometimes contribute manure loads to the surface streams. Stockpiled manure may also add to the problem.

Disposing of the washwater and manures from dairies in such a manner that the groundwaters are not degraded can be a problem. Most dairies have some associated land for waste disposal. The land is devoted to crops and pasture and its assimilative capacity will depend upon the size, crops and crop yields plus the season of year. During the summer with intensive growth the crops can utilize more nutrients than in the slow growth winter period. Small dairies with adequate crop land in close proximity may be able to use the washwaters or barn washings year round as a source of nutrient. Large dairies with smaller acreage will view the slurry wastes as a disposal problem, not a resource. Thus, there theoretically exists a threshold size for waste disposal. Regulations to achieve this size would be impractical and unenforceable. Crop land is expensive in the basin and would be difficult to acquire. However, a combination of crop patterns and pasture land best suited for each size operation should be determined and the dairymen should be encouraged to follow such a pattern. Where acreage is not available, mutually advantageous agreements between the dairymen and the neighbor cultivator could be formed for the disposal of the dairy wastes.

Sumps, holding ponds and reservoirs holding manure wastes should be protected from flood flows. No pipes, drains or ditches from the milk barn should be allowed to drain in or near a stream channel.

Irrigation Operations

Salts originate by dissolving of the more soluble portions of rocks and soil particles in rain water (weathering). Such salts are transported in solution, but are concentrated in soils, waters, and so-called salt sinks due to evaporation from soil and water surfaces and by transpiration (use) by crops (plants). This removal of water by evaporation or transpiration leaves salts behind. Salts are concentrated by each successive evaporative loss of water. In time, accumulated salt can increase in soil several fold and go from no-problem to extreme-problem levels unless some controls are applied.

For irrigated agriculture to continue production into the foreseeable future, this problem of gradual accumulation of salts in soils and waters must be faced and kept under control at acceptable levels. Otherwise, production will decline even under the best management, and no added amount of good management will be able to continue production of the quantities of food crops needed to feed our people. In most of California's water basins, the rate of export or removal of salts from the basin will need to be increased to more closely match or exceed the rate of salt accumulation. For each basin, not only do the rates of import and export of salts need to be in reasonably close balance, but the balance must also be maintained at a sufficiently low level of salinity to meet the quality demands of the various designated beneficial uses. This is often referred to as maintenance of a "favorable salt balance."

The rate of water quality degradation within a basin which results from inadequate salt exports may be slow. It may be slow enough that eventual need for control of salts is believed to be so far into the future as to be thought of no concern to present planning. However, just as degradation may be a slow process, correction of a critical basinwide salinity problem is also an extremely slow process. Good planning, now, to control this long-term, slow degradation of our soil and water resource seems the better course of action, rather than to wait until the problem becomes critical. Decisions made, or not made, now, can be critical to control in the future.

Agriculture's need for salt management is both for on-farm management and for off-farm (basin-wide) management. The absolute need for discharge of salts by agriculture will create conflicts with other water users – even other agricultural water users.

Compromises and trade-offs will be necessary to reconcile these conflicts; however, necessary motivation for change in management at the farm level will need to be tied to dollars and the economic consequences of "no-change." If required agricultural management changes for essential pollution control results in added costs to the farmer, he has the same hard choices of any other businessman:

1. Absorb the cost with reduced profit;

2. Pass on the cost in increased prices to consumers;

3. Accept some form of public subsidy to off-set cost, or

4. Go out of business.

In coastal higher rainfall areas, irrigation agriculture could probably continue almost indefinitely since irrigation would be used primarily during dry summer periods to supplement winter rainfall. Rainfall would be sufficient to flush salts through soils and provide adequate recharge and outflow from the underground water basin toward the ocean for salt control. There is more cause for concern in the drier inland basins such as the Salinas River Sub-basin and in naturally mineralized groundwater areas such as the Santa Maria Valley.

Improved Salt Management Techniques.

A concept of minimal degradation should be considered in some areas but this would need to be coupled with management of the surface and underground water supplies to minimize and correct the effects of degradation that may occur. If complete correction is not possible, improved management will delay the time that salts reach critical levels. Several options are open to correct degradation through improved salt management follow.

Improved irrigation efficiency would reduce both potential and actual pollutants in the water moving from surface to ground. Improved efficiency would also reduce total quantities of salts leaching to the water table, and cut down on withdrawals or diversions from the limited water supply. Present statewide efficiency of water use may average 50 to 60% but individual uses will vary from an estimated low of 30% where water is plentiful to a high of 95% where water quantity is limited.

Implementation of the new Leaching Requirement as recently reported by U.S. Salinity Laboratory, Riverside, will help improve efficiency of irrigation. Other research data reported on the effects of low leaching fractions in reduction of salt loads leaching to water tables. These new data offer real incentives to agriculture to improve irrigation efficiency and will mean real dollars saved by the farmer as well as real water saved by agriculture which then can be used for dilution, recharge, or nonagricultural uses. True, the salts moving to the water table under these low leaching fractions will be more concentrated, but due to low solubilities of certain salts, a progressive precipitation and removal from solution occurs as the salt concentration in the percolating soil solution rises. As the concentration rises, considerable portions of the low solubility salts come out of solution, e.g., the relatively insoluble lime, dolomite, and slightly soluble gypsum.

With these low leaching fractions, salt load to the underground may be reduced as much as 50% in some cases. Sodium salts (sodium chloride, and sulfate) are not affected so in relation to calcium and magnesium salts these sodium salts in the percolating waters increase. The compounds which precipitate are deposited in the lower root zone or below and cause no problem to agriculture except for a few specialized situations which are correctable (lime induced chlorosis). The increased proportions of sodium salts (higher SAR) will not reduce permeabilities of subsoils since salinity remains high enough to continue normal permeability. The higher sodium (SAR) reaching water tables may reduce hardness slightly and is not expected to be a problem to users of the underground waters.

Crop production can continue into the foreseeable future in the low rainfall areas if the minimal degradation that almost inevitably will occur is offset (a) by recharge and replenishment of the underground which will furnish dilution water for the added salts and (b) if drainage or removal of degraded waters occurs at a sufficient rate to maintain low salt levels and achieve a satisfactory balance between salts coming into the basin and salts leaving the basin.

To help in recharge and dilution, additional winter runoff can be stored in surface reservoirs for later use for either surface stream or underground water quantity/quality enhancement or maintenance. Existing samples include Nacimiento and Twitchell reservoirs; possible future reservoirs may be located on the Arroyo Seco and Carmel rivers. Or winter runoff could be used directly for groundwater recharge to enhance flushing and flow-through dilution of salts and pollutants.

Drainage wells which discharge to drains leading to salt sinks are a possibility in removing salty waters but these have had only limited success in draining of high water table areas. They might however, be well adapted to groundwater quality maintenance. Such wells could be drilled and operated to recover the salty top layers of water tables where salts are believed to lie as a layer of poorer quality water over the better quality deeper layers. Since most of the movement within water tables is thought to be horizontal and down-slope and vertical mixing is relatively slow, the possibility of recovering of polluted upper layers of water tables should be explored as a quality maintenance tool or as a rejuvenation procedure for degraded water supplies.

Underdrains (tile systems) can aid in both water and salt management. Perched water tables intercept percolating salts, nutrients, and other pollutants and offer real possibilities as an aid in management and protection of the over-all water quality of a basin. A "perched" water table is held up and separated from deeper aquifers by a relatively impermeable barrier (soil, rock, hardpan). This barrier often protects the deeper waters from pollution by preventing leakage of polluted waters from above. Perched water tables now exist in portions of several basins. They are expected to increase. Salts and nutrients collected in these perched water tables may be tapped by underdrains (tile systems) and transported through the basin drainage system to disposal sites.

Basin-wide or area-wide drainage systems will be needed in order to move unusable waste waters to acceptable temporary or permanent disposal sites (salt sinks). On-farm drainage problems will normally be solved at individual farmer expense because of the economics involved – the cost is not prohibitive and the costs of "not-solving" the problem (reduced yields, changing cropping patterns, or going out of business) are unacceptable. The off-farm part of drainage, however, is too big for individual farmers to solve, and some form of collective organized large scale action is needed. The off-farm problems include collection of discharges, rights-of-way for conveyance, building and maintenance of a drainage system, disposal site acquisition, and management for compliance with discharge requirements.

Acceptable temporary or permanent salt disposal sites (salt sinks) must be designated and used. The Pacific Ocean is the only acceptable sink for most of the Central Coastal Basin; however Soda Lake and certain highly mineralized groundwater basins may be acceptable. To be able to remove salts as required to maintain a low salinity level in any one basin, there must be some other basin or site that will accept the salts. These acceptor areas are known as salt sinks. Without acceptable salt sinks, salt management becomes a long-term losing battle and a frustrating exercise in futility.

Other salt inputs to a basin can be reduced by improved management of such other salt sources such as fertilizer, animal wastes, and soil amendments. Regulation may be required but an appreciable improvement can be expected by education of farmers to better understand and better utilize existing information and guidelines. A salt routing approach could be used in an area such as Paucho Rico Creek to permit discharge of highly mineralized wastewater during periods of high flow.

Individual Disposal Systems

Septic tank systems and other similar methods for liquid waste disposal are sometimes viewed as interim solutions in urbanizing areas yet may be required to function for many years. The reliability of these systems is highly dependent on land and soil constraints as well as individual maintenance which is often haphazard and rarely controlled after initial installation and inspection by local agencies. The usual septic tank maintenance carried out by individuals operating septic tank systems is limited to solids removal following some major failure of the system; usually failures that bring most rapid attention to the septic tank result in blocked plumbing and backup of sewage into the home. More common but less dramatic failure occurs when septic tank liquid effluent surfaces on the ground where nuisance odor and potential health hazards can result.

Past Regulation Problems

Past regulations of septic tank systems have been directed principally at their design and construction and have been tied with local agency building permit procedures. The standards for septic tank systems have been largely based on the U.S. Public Health Service Manual of Septic Tank Practice.

Because septic tank systems are often neglected after their construction, maintenance is rare except in cases of major failure. Some kind of followup procedure is necessary to insure home owners are providing maintenance of their system and are not ignoring symptoms of septic tank failure. Recognizing the need for followup procedures, some agencies have adopted strict ordinances governing septic tank systems which provide for biennial inspection and a permit procedure which, in effect, conditions operation of the disposal system. This procedure is designed to assure the system is continuing to function properly through a report of inspection. When appropriate proof of repairs or alterations to a system, as well as proof of septic tank pumping by a licensed pumper, is required by the inspector. The ordinance contains enforcement procedures giving the inspector the right of entry under specified procedures.

Corrective Actions for Existing Systems

Individual disposal systems can be regulated with relative ease when they are proposed for a particular site; regulations generally provide for good design and construction practices and permit systems can be made a condition for building. A more troublesome problem is presented by older existing septic tank systems where design and construction may have been less strictly controlled and where land development has intensified to an extent that percolation systems are too close together and there is no room left for construction of replacement leaching areas. Where this situation develops to an extent that public health hazards and nuisance conditions develop, the most effective remedy is usually a sewer system. Where soil conditions are favorable for percolation, problems may not be obvious but groundwater degradation is possible, particularly nitrate buildup. Sewer system planning should be emphasized in urbanizing areas served by septic tanks; a first step would be a monitoring system involving surface and groundwaters to determine whether problems were developing. Where septic tank systems in urbanized areas are not scheduled for replacement by sewers and where public health hazards are not documented, septic tank maintenance procedures are encouraged to lessen the probability that a few major failures might force sewering of an area which otherwise could be retained on individual systems without compromising water quality. Often a few systems will fail in an area where more frequent septic tank pumping, corrections to plumbing or leach fields or in-home water conservation measures could correct the system. These kinds of improvements should be enforced by a local septic tank management district or the county.

Where water use is high, the septic tank receives a greater hydraulic load and failure can occur due to washout of solids into percolation areas causing plugging of the infiltrative surface. In such cases, home dishwashers, garbage grinders, and washing machines could be eliminated; in some cases, excess wash water could be diverted to separate percolation areas by in-home plumbing changes. Water saving toilets, faucets, and shower heads are available to encourage low water use. Inverse water rates also encourage more frugal use of water.

Criteria for New Systems

New septic tank systems should generally be limited to new divisions of land having a minimum parcel size of one acre, except where soil and other physical constraints are particularly favorable. In these cases, parcel size should not be less than one half acre. Subdivisions based on parcel size less than one half acre should be sewered regardless of soil suitability; in some cases, sewers can be deferred until build out reaches an equivalent density; however, alternate parcels must be left vacant to separate percolation systems and provide for fail-safe areas for replacement leach fields until sewers are available. Where parcel area is between one and five acres, future subdivisions may be permitted to develop septic tank systems so long as physical constraints are met; generally areas developed on parcels larger than five acres will not be required to provide sewers.

Physical constraints are principally related to depth of water table, depth of soil, ground slope and presence of water courses. Depth to bedrock or other impervious material should be greater than eight feet and depth to groundwater should be greater than ten feet at all times during the year. Ground slope should not exceed 30 percent. Exceptions to these constrains will be considered for engineering systems where sufficient justification is provided. Septic tanks and leaching systems shall not be planned for any area where it appears that the total discharge of leachate to the geological system under fully developed conditions will cause damage to public or private property, degrade groundwater or create a nuisance or public health hazard; interim use of septic tank systems may be permitted where alternate parcels are held in reserve until sewer systems are available.

Septage Disposal

Disposal of septage, the solid residues pumped from septic tanks, must be accomplished in an acceptable manner. In some areas disposal may be to either a class I of II solids waste site; in others, this material will be discharged to a municipal treatment facility where such discharges can be accommodated. Wastewater treatment facilities in areas where septic tanks are also prevalent should consider special pretreatment measures to insure septage discharged does not disrupt and compromise treatment in the plant. Some facilities may prohibit septage discharge; however, where no treatment facility is available to service septage, such service should be provided by municipal agencies. To insure reliability of treatment, chemical toilet wastes should not be accepted; these more toxic substances which may harm biological treatment processes should be contained in class I solid waste sites.

Septic Tank Management

Unsewered areas developed on small lots (less than one acre size) should be administered by local septic tank maintenance districts, preferably as established by County government. These special districts could be administered through existing local governments such as a County Water District, a Community Services District, or a County Service Area. In many cases, densely populated areas may be sewered in the near future; however, maintenance district programs could include initiation of sewerage facility planning tailored to community needs wherein some areas may need to be retained on septic tanks rather than overburden community financing by extensive sewering programs. Septic tank management district approaches have been recommended for the San Lorenzo Valley, Carmel Highlands, Shandon, Los Osos-Baywood, Nipomo, and unsewered areas of the community of Santa Ynez.

Recommended Program for Individual Treatment Systems

It is recommended that individual treatment systems be retained in several areas prior to the establishment of the fact that problems exist which can only be corrected by sewering. Areas which are presently unsewered and which should undertake studies to determine the necessity of constructing sewers include San Lorenzo Valley, Carmel Valley, Los Osos-Baywood Park, Nipomo and Santa Ynez. In other areas, such as Los Alamos and the subdivisions south of the City of San Luis Obispo, the Regional Board should monitor the rate of urban development to determine when such studies are needed.

These studies, which should be closely coordinated with the Regional Board, should identify the significance of present water quality problems and should formulate alternative wastewater management plans that will alleviate those problems. The studies should indicate whether complete sewering, partial sewering, sewering at some later date or no sewering is necessary. The results of such studies would be used as a basis for revisions of the Basin Plan.

The studies should encompass an investigation of measures which, if implemented, could solve or at least minimize immediate problems with existing systems. They include enforced septic tank maintenance and pumping schedules, corrections to plumbing or leach fiedls, and in-the-home water conservation measures.

The studies should identify the cost to the homeowner of providing a wastewater collection and treatment system. A cost-effectiveness analysis which considers the socio-economic impacts of alternative plans should be used to select the implementation plan. In some communities, the increased cost of wastewater collection may be an unbearable burden to retired homeowners on a fixed income. Where nitrate problems are occurring in the groundwater supply of such communities, the use of bottled water should be considered as an interim measure pending determination of means to remove nitrogen from the community's water supply or wastewater.

In the Los Osos-Baywood Park area, engineering studies should be implemented to yield data on the characteristics of the groundwater basins which are believed to underlie the area. If the engineering study finds that septic tank leachings are the cause of otherwise controllable groundwater degradation, the construction of septic tanks should be prohibited. Similarly, if septic tanks turn out to be the best option for Los Osos-Baywood, then they should be placed such that the waste fields leach into the groundwater basin containing the lowest quality water. It may be possible to identify septic tank management approaches to help maintain workable individual systems in unsewered areas.

The objective of this recommended study is to identify a wastewater management system that will avoid nitrate and TDS buildups in a groundwater basin of excellent quality and the prevention of public health hazards generated by the contamination of groundwaters. In other areas, where problems such as the surfacing of septic tank drainage and backup of sewage into individual homes are occurring, the scope of engineering studies should also include solving these problems.

The implementation plan calls for the phasing out of septic tanks and the sewering of all areas where serious problems can be documented and where projected future population densities warrant it. Engineering studies will be needed, in most cases, to determine the most cost-effective solution to the specific problems facing each area.

Construction, Mining, and Logging Activities

Construction, mining, and associated activities which may distrub or expose soil or otherwise increase susceptibility of land areas to erosion are difficult to regulate effectively. Construction or logging may often begin and end with no obvious impairment of stream quality; however, erosion or land slides the following winter may be directly related to earlier land disturbance or tree cutting. Mining and quarrying activities are generally longer in duration. Land sensitivity to erosion can be assessed before land disturbances are permitted; environmental constraints could be identified for use in screening construction or logging permits and could be a basis for adding special conditions to waste discharge requirements where applicable.

Construction Activities

Road construction is often a cause of water quality impairment; all too often roads are located near streams and side fills may be eroded by flood waters. Construction within stream beds will inevitably cause turbidity; however, the timing of such activities could be established with reference to environmental sensitivity factors such as fish migrations, spawning or hatching, and minimum streamflow conditions. Sediment loads can be reduced by proper timing, bank and channel protection and use of settling ponds to catch silt. Construction debris should be left in the flood plain; revegetation of cuts and fills should be encouraged. Land development projects in sensitive areas should be scheduled so as to minimize the areal extent of land exposed to erosive forces. Where water quality impairment is likely, permits should be issued by the Regional Water Quality Control Board which will insure against water quality degradation. Cooperation of local approving agencies should be obtained in order that approvals of significant subdivisions in environmentally sensitive areas, particularly the upper reaches of water sheds and lands near riparian habitats, are appropriately conditioned. For example, proposed subdividions of 50 lots or more in such areas should be 1) covered by environmental impact reports on the development and its impact on waste loads and water quality, 2) be in conformance with regional or county master plans, and 3) include provisions for establishment of a public agency responsible for environmental monitoring and maintenance where such subdivisions are outside other appropriate public jurisdictions.

Mining Activities

Mining and petroleum related activities including abandoned mines or well fields affecting water quality should be covered by up-to-date waste discharge permits and monitoring programs. Offshore oil operations, mercury mines and gravel operations should receive high priority in this regard. Monitoring of coastal waters should include oil surveillance from federal lease areas to state waters.

Logging Activities

Sensitivity of all streams in the basin to logging and logging road building activities could be identified following rigorous analysis of geological, pedological, hydrological and biological data plus field inspections. Relative sensitivity could then be portrayed on a large map. The sensitivity would also consider beneficial uses which are not directly associated with ecological systems. Upon receiving a timber harvest plan, the Regional Board staff could locate the operation on the sensitivity map and determine the approximate amount of risk involved. This information would enable the board to evaluate the method of operation and the adequacy of proposed mitigation actions or special considerations. The success of this step would somewhat depend upon the degree of cooperation provided by the Division of Forestry. Timber harvest plans should be required to contain sufficient detail for evaluation, and the Regional Board should be allowed an ample amount of time for review before commencement of logging operations.

The proper logging method to be used at each setting is a function of the terrain, species and other timber considerations. Often the aforementioned are compatible with water quality management, but in cases where water quality may be degradated, mitigating measures to preserve the character and quality of the water course should be taken. Since the Division of Forestry is familiar with the limitations and relative degradation potential of the various harvest methods, it should take the lead role in incorporating necessary mitigation measures into the permits and seeing that they are enforced.

Two possibilities exist to deal with negligent operators. The Division of Forestry can revoke the operator's license or the Regional Board can implement enforcement action. While both methods are necessary and effective, they are after-the-fact methods except for deterring roles. Thus, the major emphasis should be placed on control measures rather than enforcement actions.

CONTROL ACTIONS

In order to ensure that the beneficial uses of water resources are preserved, the State Water Resources Control Board and the Central Coast Regional Water Quality Control Board have adopted a number of policies and plans to serve as a foundation for water quality management and as guidelines for facilities development. The following subsections contain a summary of these policies and plans. Where required, suggested modifications are presented.

State Water Resources Control Board

The State Board has adopted a number of plans and policies for statewide water quality management including:

State Policy for Water Quality Control (1972)
Ocean Plan
Thermal Plan
Nondegradation Policy
Bays and Estuaries Policy

The following subsections summarize the adopted policies.

State Policy for Water Quality Control

The State Board has developed a set of 12 general principles to implement the provisions and intent of the Porter-Cologne Act. These principles, listed below, are contained in a document called the State Policy for Water Quality Control, adopted on July 6, 1972.

1. Water rights and quality control decisions must assure protection of fresh and marine waters for maximum beneficial use.
2. Wastewaters must be considered a part of the total available fresh water resource.
3. Management of supplies and wastewaters shall be on a regional basis for efficient utilization of the resource.
4. Efficient wastewater management requires a balanced program of source control of hazardous substances, treatment, reuse and proper disposal of effluents and residuals.
5. Substances not amenable to removal in treatment plants must be prevented from entering the system.
6. Treatment systems must provide sufficient removals to protect beneficial uses and aquatic communities.
7. Institutional and financial programs of consolidated systems must serve each area equitably.
8. Sewerage facilities must be consolidated for long-range economic and water quality benefits.
9. Reclamation and reuse for maximum benefit shall be encouraged.
10. Systems must be designed and operated for maximum benefit from expended funds.
11. Control methods must be based on the latest information.
12. Monitoring programs must be provided.

The policy provides that secondary treatment will be the minimum acceptable level of treatment. Advanced treatment systems will be required where necessary to meet water quality objectives.

Ocean Plan

The "Water Quality Control Plan for Ocean Waters of California", adopted by the State Water Resources Control Board on July 6, 1972, is designed to protect the quality of the ocean waters for use and enjoyment by the people through the control of waste discharges to the ocean. The plan sets forth water quality objectives for ocean waters. The objectives impose limits on bacteriological, physical, chemical, biological, toxic, and radioactive characteristics for ocean waters in numerical and descriptive terms. The plans describe requirements for management and design of systems discharging wastewaters to the ocean and effluent quality requirements for discharges. Systems must be designed and operated in a manner that will maintain the indigenous marine life and a healthy and diverse marine community. Effluent quality limitations are numerical. Discharge prohibitions are placed on hazardous substances, warfare agents and high level radioactive wastes, sludge and digester supernatant, and bypassed untreated waste discharges. Areas of Special Biological Significance are to be designated in which maintenance of natural quality conditions must be assured. Discharge requirements must include maximum allowable daily mass emission rates and maximum allowable monthly mass emission rates for each effluent quality constituent included therein.

Thermal Plan

The State Water Resources Control Board adopted, on May 18, 1972, a "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries in California", referred to as the "Thermal Plan". The plan specifies limiting conditions of temperature in wastewaters discharged into interstate and coastal waters, estuaries and enclosed bays. For example, elevated temperature waste discharges into interstate waters designated as "cold" waters are prohibited, while this type of discharge into "warm" interstate waters cannot be more than 5°F warmer than the receiving water and shall not cause the temperature in the receiving water to rise more than 5°F. Existing thermal discharges into coastal waters, estuaries and enclosed bays shall comply with limitations necessary to assure protection of the beneficial uses and, for coastal waters, areas of special biological significance. Other specific limitations are contained in the plan. Regional Boards administer the plan by establishing waste discharge requirements for discharges of elevated temperature wastes. Existing and future dischargers of thermal waste are required to define the effect of the discharge on the beneficial uses, and for existing discharges, determine the necessary design and operating changes needed to comply with the plan objectives. The plan requires the earliest possible compliance, but not later than January 1, 1976.

Nondegradation Policy

Resolution No. 68-16 of the State Water Resources Control Board is the "Statement of Policy with Respect to Maintaining High Quality of Waters in California", commonly referred to as the "Nondegradation Policy". The quality of some of the waters of the State is higher than that established by the adopted policies and it is the intent of this policy that such higher quality be maintained to the maximum extent possible. Wherever this condition exists, such high quality will be maintained unless it can be demonstrated that any change will be consistent with maximum benefit to the people of the State.

Bays and Estuaries Policy

The "Water Qualty Control Policy for the Enclosed Bays and Estuaries of California", Resolution No. 74-43, was adopted by the State Water Resources Control Board on May 16, 1974. Commonly referred to as the "Bays and Estuaries Policy", it was adopted to specifically provide water quality principles and guidelines for the affected waters. Decisions by the Regional Boards are required to be consistent with the provisions designed to prevent water quality degradation and to protect beneficial uses. the policy lists principles of management that include a statement of the desirability of phasing out all discharges (exclusive of cooling waters) as soon as practicable. Quality requirements state conformability with other plans and policies. Discharge prohibitions are placed on new dischargers (other than those that would enhance the receiving waters); untreated waste and waste products; refuse, consequential effects of mining, construction, agriculture, and lumbering; materials of petroleum origin; radiological, chemical, or radioactive waste; and high-level radioactive waste.

Recommended Control Actions

The following listed actions are recommended for implementation or for future consideration by the State Water Resources Control Board, as appropriate. These recommendations are:

1. The State Water Quality Control Plan for Ocean Waters of California should be revised and updated in 1975 following final publication of Water Quality Criteria for Water Quality and Information for the Restoration and Maintenance of Aquatic Integrity, and the Measurement and Classification of Water Pursuant to Section 304 (a)1 of 2. Public Law 92-500.

2. State policies for surface waters and for bays and estuaries should be further considered in light of information cited in 1 above.

3. State policies for water quality control should place more emphasis on water quality monitoring to determine compliance with water quality objectives in order to provide a firm basis for classification of receiving waters relative to Section 303e of Public Law 92-500.

4. Erosion control policies to enforce improved practices and applicable prohibitions to land development, road construction, mining and logging activities should be formulated for statewide application; these policies should contain regionalized factors or be provided as guidelines for final formulation by the Regional Water Quality Control Boards.

5. Land use planning relative to non-point pollution sources should be considered as a future activity, possibly as a multiagency effort; initial control efforts and means for effective control should be from local agencies.

6. Water quality control programs should continue to include emphasis on total water management in order to permit enhancement of naturally degraded surface and ground waters.

7. Policies affecting water rights should reinforce water quality goals particularly as related to long-term groundwater salinity changes. Adjudication of degraded groundwater basins should be considered as a tool for implementation of water quality goals; however only if other measures fail.

8. Water supply improvements to reduce influent wastewater salinity made in the interest of total water quality management should be considered for partial eligibility for Clean Water Grants. Increase costs for grant eligibility could be in lieu of costs for wastewater effluent demineralization where such measures are required.

9. Water reclamation and reuse programs for supplementing agricultural irrigation supplies should be given increased emphasis. Grant support should be available for water short areas where such water demand can be demonstrated.

10. The non-degradation policy of 1968 should be revised or clarified to recognize short-term and long-term aspects of groundwater management as affected by irrigated agriculture and an environmental impact assessment should be prepared on this policy.

Regional Water Quality Control Board

Goals

To insure that the water resources of the Central Coastal Basin are preserved for future generations of Californians, the California Regional Water Quality Control Board, Central Coast Region, determined it was desirable to establish certain planning goals. These goals pertain to utilization of the basin's water resources and guidelines for control of waste discharges, as follows:

1. Protect and enhance all basin waters, surface and underground, fresh and saline, for present and anticipated beneficial uses, including aquatic environmental values.
2. The quality of all surface waters shall be such as to permit unrestricted recreational use.
3. Manage municipal and industrial wastewaters as part of an integrated system of fresh water supplies to achieve maximum benefit of fresh water resources for present and future beneficial uses and to achieve harmony with the natural environment.
4. Achieve maximum effective use of fresh waters through reclamation and recycling for agriculture, industry, and municipalities.
5. Continually improve waste treatment systems and processes to assure consistent high quality effluents at minimum cost.

Management Principles

The following general water quality objectives include guidelines for treating and disposing of wastes:

1. Water quality management systems throughout the basin shall provide for eventual wastewater reclamation, but may discharge wastes to the aquatic environment (with appropriate discharge requirements) when wastewater reclamation is precluded by processing costs or lack of demand for reusable water.
2. The number of waste sources and independent treatment facilities shall be minimized and the consolidated systems shall maximize their capacities for wastewater reclamation, assure efficient management of, and meet potential demand for reclaimed water.
3. All discharges to the aquatic environment shall be considered temporary unless it is demonstrated that no undesirable change will occur in the natural receiving water quality.
4. Land use practices should assure protection of beneficial water uses and aquatic environmental values.
5. Municipal and industrial sewering entities should implement comprehensive regulations to prohibit the discharge to the sewer system of substances listed below which may be controlled at their source:

Chlorinated hydrocarbons
Toxic substances
Harmful substances that may concentrate in food webs
Excessive heat
Radioactive substances
Grease, oil, and phenolic compounds
Mercury or mercury compounds
Excessively acidic and basic substances
Heavy metals such as lead, copper, zinc, etc.
Other known deleterious substances

6. Sewering entities should implement comprehensive industrial waste ordinances to control the quantity and quality of organic compounds, suspended and settleable substances, dissolved solids, and all other materials which may cause overloading of the municipal waste treatment facility.
7. Applicants for state and federal grants for construction of waste treatment facilities shall be required to submit proof of implementation of adequate source control and industrial waste ordinances, including an equitable system of cost recovery.
8. Groundwater recharge with high quality water shall be encouraged.
9. In all groundwater basins known to have an adverse salt balance, the total salt content of the discharge shall not exceed that which normally results from domestic use, and control of salinity shall be required by local ordinances which effectively limit municipal and industrial contributions to the sewerage system.

10. Wastewaters percolated into the groundwaters shall be of such quality at the point where they enter the ground so as to assure the continued usability of all groundwaters of the basin.
11. The quality of all surface waters of the basin shall be such as to permit unrestricted recreational use.
12. The discharge of pollutants into surface fresh waters shall be discontinued prior to July 1, 1985.
13. There shall be no waste discharged into areas which possess unique or uncommon cultural, scenic, aesthetic, historical or scientific values. Such areas will be defined by the Regional Board.
14. The Regional Board intends to discourage high density development on septic tank disposal systems and generally will require increased size of parcels with increasing slopes and lower percolation rates. Consideration of development will be based upon the percolation rates and engineering reports supplied. In any questionable situation, engineered designed systems will be required.

Discharge Prohibitions

Due to unique cultural, scenic, aesthetic, historical, scientific, and ecological values of the Central Coastal Basin, and the necessity to protect the public health and the desire to achieve water quality objectives, the Regional Water Quality Control Board has established certain discharge prohibition.

All Waters. The discharge of oil or any residual products of petroleum to the waters of the State, except in accordance with waste discharge requirements, or other provisions of Division 7 of the California Water Code is prohibited.

Inland Waters. Waste discharges to the following inland waters are prohibited:

1. All surface, fresh water impoundments and their immediate tributaries.
2. All surface waters within the San Lorenzo River, Aptos-Soquel, and San Antonio Creek Sub-basins and all water contact recreation areas

located in fresh waters except where benefits can be realized from direct discharge of reclaimed water.
3. All dead end sloughs receiving little flushing action from land drainage or natural runoff.
4. All coastal surface streams and natural drainage ways that flow directly to the ocean within the Santa Cruz Coastal, Monterey Coastal, San Luis Obispo Coastal from the Monterey county line to the northern boundary of San Luis Obispo Creek drainage, and the Santa Barbara Coastal Subbasins except where discharge is associated with an approved wastewater reclamation program.
5. The Santa Maria River downstream from the Highway 1 bridge.
6. The Santa Ynez River downstream from the salt water barrier.

In addition, discharge from individual sewage disposal systems, including but not limited to septic tank seepage pits and adsorption fields, cesspools, pit privies, chemical toilets, etc., is prohibited:

1. On all parcels of land within the projected horizontal distance of 200 feet of all reservoirs and impoundments as determined by the spillway elevation.
2. Within a reservoir watershed, on individual parcels of land of less than 2.5 acres beyond the projected horizontal distance of 200 feet from the high water elevation of reservoirs and impoundments, as determined by the spillway elevation.
3. On individual parcels of land where any part of the disposal system is within a horizontal distance of 100 feet of surface streams, natural watercourses or domestic water supply wells.
4. On parcels of land less than 0.5 acres in new divisions of land not located on reservoir watersheds where depth of usable groundwater is less than 100 feet below ground surface unless sufficient engineering justification is provided to prove beneficial uses will be protected.

The discharge of solid waste materials is prohibited under the following conditions and/or in specific locations:

1. Any Class I solid waste material to any location other than Class I solid waste disposal site.
2. Any Class II solid waste materials to any location other than Class I or II solid waste disposal sites.
3. Solid wastes shall not be discharged to rivers, streams, creeks, or any natural drainage ways or flood plains of the foregoing.

The discharge of wastes which do not comply with the following conditions are prohibited:

1. Wastes discharged to surface waters shall be essentially free of toxic substances, grease, oil, and phenolic compounds.
2. Wastes discharged to groundwaters shall be free of toxic substances in excess of accepted drinking water standards; taste, odor, or color producing substances and nitrogenous compounds in quantities which could result in a groundwater nitrate concentration above 45 mg/l.
3. Waste discharges shall not contain materials in concentrations which are hazardous to human, plant, animal, or aquatic life.

The discharge of elevated temperature wastes in excess of the liquids specified in Chapter 4 Water Quality Objectives into COLD intrastate waters is prohibited.

The discharge of soil, silt, bark, slash, sawdust or other organic and earthen materials from any logging, construction, or associated activity of whatever nature into any stream in the basin in quantities deleterious to fish, wildlife, and other beneficial uses is prohibited.

The placing or disposal of soil, silt, bark, slash, sawdust or other organic and earthen materials from any logging, construction, or associated activity of whatever nature at locations above the anticipated high-water line of any stream in the basin where they may be washed into said waters by rainfall or runoff in quantities deleterious to fish, wildlife and other beneficial uses is prohibited.

Wasters Subject to Tidal Action. Waste discharges to the following areas are prohibited:

1. Effective July 1, 1977, in Monterey Bay, northern and southern extremes within the following areas: inshore from a line extending from Santa Cruz Point to the mouth of the Pajaro River; and inshore from a line extending from Point Pinos to the mouth of the Salinas River; and the offshore area within a three-mile radius of Point Pinos.
2. Carmel Bay, within 1000 feet from the Point Lobos Preserve of the State Department of Parks and Recreations, as recorded in 1970.
3. Tidal waters within 1000 feet of the coast and 100-foot depth contour, measured from mean

low water. An exception to this prohibition may be allowed by the Board in prescribing waste discharge requirements after finding that all beneficial water uses will otherwise be protected.

The discharge of any radiological, chemical, or biological warfare agent or high level radioactive waste into the ocean is prohibited.

The discharge of wastes into Areas of Special Biological Significance or close enough to such areas to alter their natural water quality conditions is prohibited.

The discharge of municipal and industrial waste sludge and sludge digester supernatant directly to the ocean, or into a waste stream that discharges to the ocean without further treatment is prohibited.

The bypassing of untreated waste to the ocean is prohibited.

No person, whether engaged in commerce or otherwise, shall place, throw, deposit or discharge, or cause to be placed, thrown, deposited or discharged on or in tidal waters any untreated waste or waste matter, except vessel wash down water, from any vessel.

The discharge of oil or grease from other than natural sources which produces a visible or measurable effect to tidal waters of the basin is prohibited.

New thermal waste discharges to coastal waters, enclused bays and estuaries having a maximum temperature greater than 4°F above the natural temperature of the receiving water are prohibited.

Recommended Control Actions

1. The Regional Water Quality Control Board should implement water quality control plan provisions through establishment of requirements and timetables for compliance with plan actions.

2. Priorities for State Clean Water Grants should be ordered by the Regional Water Quality Control Board and provide ever increasing emphasis toward correction of basin water quality problems.
3. Regional Board policies should emphasize control of water softener brine disposal into public sewer systems by requiring affected dischargers to comply with normal salt increments, adopt salt source control ordinances, and to conduct wastewater monitoring programs.
4. Water supply improvements (which encourage cost-effective water quality management) beyond normal source control measures, i.e., water supply quality enhancement by treatment or other means in lieu of effluent demineralization, should be recommended for grant support.
5. Unsewered areas having high density (one acre lots or smaller) should be organized into septic tank management districts and sewerage feasibility studies should be encouraged in potential problem areas. Local implementation should be encouraged by Regional Board action.
6. Waste discharge requirements should be established for all (operating) solid waste sites and where inactivated sites may contribute to water quality impairment.
7. Waste discharge requirements should be established for all existing oil well fields, mines, or other well fields which threaten water quality.
8. Waste discharge requirements should be established for all irrigation, feedlot, dairy, and poultry operations which are so located as to pose a clear and direct threat to water quality; such operations need not be so large as to require a permit under NPDES.
9. Industrial schedules of compliance with the State Ocean Plan and PL 92-500 including timetables, should be established by mid-1976. Dischargers should effect compliance with the 1977 and 1983 effluent limitations.
10. The Regional Water Quality Control Board should initiate coordination with the appropriate Coastal Commission, as well as other state, federal, and local agencies which possess related or overlapping planning responsibilities.
11. Animal confinement facilities plus adjacent crop lands under the control of the operator shall have the capacity to retain surface drainage from manure storage areas plus any washwater during a 10-year 24-hour storm by 1977 and during a 25-year 24-hour storm by 1983.
12. Surface drainage, including water from roofed areas, shall be prevented from running through manure storage areas.
13. Animal confinement facilities, including retention ponds shall be protected from overflow to stream channels during 20-year peak streamflows for existing facilities and 100-year peak streamflows for new facilities.
14. Washwater and surface drainage from manure storage areas shall be contained, applied to crop lands, or discharged to treatment systems subject to approval by the appropriate Regional Water Quality Control Board.

15. Animals in confinement shall be prevented from entering surface waters.

16. Lands that have received animal wastes shall be managed to minimize erosion and runoff. Dry manures applied to cultivated crop lands should be incorporated into the soil soon after applications.

17. Animal wastes shall be managed to prevent nuisances in manure storage areas.

18. Manure storage areas shall be managed to minimize percolation of water into underlying soils; this may be accomplished by routing drainage to impervious storage areas, land applications, relocation of existing lots and, in the case of new locations, by selecting more impervious soils for manure storage areas.

19. Animal confinement facilities shall have adequate surface drainage to prevent continuous accumulation of surface waters in corrals and feedyards; drainage should be routed to impervious storage areas or applied to land.

20. Application of manures and washwaters to crop lands shall be at rates which are reasonable for crop, soil, climate, special local situations, management system and type of manure.

21. Designate temporary or permanent salt sinks within each water basin that can accept waters of quality too poor for reuse in agriculture. As a minimum step, designate the Pacific Ocean and Soda Lake as acceptable salt sinks.

22. Minimize degradation of water during transport from points of use; minimize leakage of poor quality water during transport from salt affected areas through salt free lands to salt sinks for disposal.

23. Regulate importation of water into any basin or sub-basin and regulate the reuse of waters in upstream portions of sub-basins which is of poorer quality than existing or imported supplies. If such import or transport to up-slope areas for reuse is allowed, take suitable steps to mitigate short and long-term adverse effects of increased salt load resulting from this recycling.

24. Increase recharge of underground water storage basins (where recharge is possible) using surplus winter or spring runoff waters.

24. Actively support measures designed to protect and to improve quality of waters imported into areas with unfavorable or poor salt balance.

26. Regulate reclamation of new lands which would contribute large quantities of salts or pollutants to water supplies.

27. Where water supplies are limited, restrict use of reclaimed waters to existing irrigated acreage rather than develop new irrigated acreage to utilize the reclaimed water.

Recommended Actions by Other Authorities

1. The Association of Monterey Bay Area Governments (AMBAG) should coordinate with local agencies relative to implementation of water quality control plans in that area.

2. Federal agencies directly affected by the facility plans involving consolidation with other communities should comply with applicable provisions of the basin plan; the Federal Correctional Institute near Lompoc and Fort Ord on the Monterey Peninsula are shown as part of municipal wastewater sewerage consolidation plans; agency policies favoring plan recommendations are encouraged.

3. Federal agencies otherwise affected by plan provisions should signify their compliance or concern with plan recommendations; time at public hearings will be provided for this purpose.

4. County governments should revise septic tank ordinances to conform with basin plan recommendations and State Board guidelines.

5. Formation of septic tank management districts within existing local agencies should be accomplished in areas where directed by Regional Board action.

6. Conjunctive groundwater-surface water management should continue to be encouraged by water management agencies, both in terms of storage and recharge operations and containment and routing of highly mineralized surface waters to prevent recharge. Examples in the Salinas Subbasin include storage of wet weather flows and recharge from a reservoir on Arroyo Seco and containment to prevent recharge of highly mineralized surface waters in streams such as Poncho Rico Creek. Other proposed conjunctive water management projects are discussed in Chapter 13.

7. Preparation of solid waste management plans by all counties in the basin should be accomplished as required by the Nejedly-Z'berg-Dills Solid Waste Management and Resource Recovery Act of 1972.

8. Local agricultural representatives and the University of California extension service should maintain liaison with the Regional Water Quality Control Board and the State Board relative to agricultural wastewater management and the Santa Maria Valley Groundwater Quality Study.

9. Water quality in offshore oil lease areas should be monitored by State and federal agencies preferably by arrangements with independent oceanographic institutions.

10. Salt source control measures should be implemented by municipalities having excessive mineral quality in wastewaters discharged to land or inland waters; control of salinity through water supply improvements is recommended.

Legislation

1. Legislation establishing eligibility of specific water supply improvements made in the interest of total water management is recommended; such legislation should allow costs for salinity reductions in municipal water supplies as in lieu costs of wastewater effluent demineralization where required by State or Regional Board policies.

2. Legislation strengthening the role of the State Water Resources Control Board in the area of land use planning relative to non-point wastewater source control is recommended; such legislation should initiate a study of environmental sensitivity relative to non-point pollution control methodology.

3. Lesislative strengthening the Porter-Dolwig Groundwater Basin Protection Law (1961) is recommended wherein the State Water Resources Control Board is empowered to analyze, prescribe and enforce legal, institutional and technical solutions in areas having groundwater degradation. Water rights aspects of such legislation should empower thy State Board to grant water rights based on need and water quality management considerations rather than precedence.

Chapter 6 Plan Assessment

Water quality management plans were developed with an awareness of the many resources to be protected in the Central Coastal Basin and with an understanding of physical and other constraints which limit local planning options. The present environment has been considered in terms of wildlife, fisheries, recreation and scenic values as well as cultural factors of land use and archeology. Wastewater facility plans and non-point control measures described in Chapter 5 were selected after an evaluation of the environmental impacts associated with each alternative. These alternatives and the environmental ratings are described in Chapters 16 and 17.

Requirements of the National Environmental Policy Act (Public Law 91-90) and the California Environmental Quality Act have been considered in the selection of water quality management plans for the Central Coastal Basin. This chapter reviews aspects of the present environment which are considered sensitive to wastewater management recommendations presented in Chapter 5 and provides an environmental assessment for each plan in terms of major implications of the plans relative to environmental quality. These environmental impact assessments list major beneficial and adverse impacts, identify mitigating factors, discuss long term productivity and resource commitments and identify growth inducement or growth accommodating elements.

THE PRESENT ENVIRONMENT

California's picturesque Central Coast Region extends along a southern axis from Pescadero Point in San Mateo County to Rincon Point in Ventura County. The inland basin covers most of Santa Cruz, Monterey, San Benito, San Luis Obispo, and Santa Barbara counties as well as parts of San Mateo, Santa Clara, Kern and Ventura counties. Generally rectangular, the basin is about 350 miles long and 50 miles wide, covering an area of 11, 274 square miles.

Topographic features are dominated by a rugged seacost and three parallel ranges of the Southern Coast Mountains. Ridges and peaks of these mountains, the Diablo, Gabilan and Santa Lucia Ranges, reach to 4,000 feet. Between these ranges are the broad valleys of the San Benito and Salinas Rivers. These Southern Coast Ranges abut against the west to east trending Santa Ynez Mountains of the Transverse Ranges.

This coastal area includes urbanized and agricultural areas along Monterey Bay, the rugged Big Sur Coast, Morro Bay with its famous rock, the sandy clam beds of Pismo Beach and a varied coastline south to Point Conception and eastward along the terraces and recreational beaches which line the Santa Barbara Channel. The inland valleys and cities reflect an agricultural, oil and tourism economy, as well as the early history of California expressed in the architectural styles of the famous Spanish missions which are found throughout this region.

The trend of the mountain ranges, relative to onshore air-mass movement, imparts a marked climatic contrast between seacoast, exposed summits, and interior basins. Variations in terrain, climate and vegetation account for a multitude of different landscapes; seacliffs, sea stacks, white beaches, cypress groves, and redwood forest along the coastal strand contrast with the dry interior landscape of small sagebrush, short grass and low chaparral.

In times past, the beaches and ocean waters offshore have been prolific producers of clams, crustaceans, and important sport and commercial fish. Past fishing pressure and disruption of habitat have reduced fishery resources; protective controls are now in effect.

Terrestrial wildlife includes a wide range of valley and upland species including the more common raccoon, quail, and deer. Rare, endangered, or unique species include various shore birds, the Morro Bay kangaroo rat, the European boar and the California condor. The Sespe Condor Range serves as a sanctuary for this impressive bird.

Several hundred archeological sites associated with former Indian cultures have been located in the area. Due to their antiquity and composition, archeological sites are extremely fragile and subject to natural as well as human destruction. As such, these sites are highly sensitive to the construction of wastewater management facilities.

Historically, the economic and cultural activities in the basin have been agrarian. Livestock grazing persists, but it has been combined with hay cultivation in the valleys. Irrigation, with pumped local groundwater, is very significant in inter-mountain valleys throughout the basin. Mild winters result in long growing seasons and continuous cultivation of many vegetable crops in parts of this basin.

Cultivation and processing of the agricultural products have provided some employment as have the oil extraction industry and a small and scattered array of non-related manufacturing. Oil production is a major activity over inland well fields and in offshore waters. Tourism is an important part of the basin economy due mainly to its unspoiled and scenic coastline, cool summers and mild winters.

Monterey Bay Region

In the northern area of the basin, Monterey Bay is widely known for its white beaches, sea cliffs, hsitorical heritage and marine life productivity. Resources of Monterey Bay include kelp beds from Seaside westward on the southern coast and near Santa Cruz in the North Bay. Fisheries include salmon, rockfish, ling cod, halibut, white croaker, sole, sable fish, surf perch, market crab, squid, and pismo and little neck clams. Many of these habitats are shown on Fig. 6-1. Recreational areas oriented to these fisheries as well as other water oriented recreation pursuits are shown on Fig. 6-2.

The AMBAG Oceanographic Survey, conducted in 1971-72 has gathered new data and synthesized past information for use in ecological modeling studies designed to simulate the response of Monterey Bay to waste discharges. Data gathered included information on currents and sensitive habitats. Some general information on Monterey Bay is useful prologue to discussions on environmental impact of the recommended plan.

Physically, Monterey Bay is a 25 mile wide crescent extending from Point Santa Cruz on the north to Point Pinos on the south. Bay waters reach depths of 50 meters within about two miles from the Monterey Peninsula area north to Moss Landing and are generally more shallow in the northern Bay where comparable depths are twice to triple this distance from shore between Watsonville and Santa Cruz. Off Moss Landing, a deep submarine canyon leads westward to depths exceeding 500 meters about 12 miles offshore. Upwelling of deep oceanic waters from this canyon contribute nutrients to surface waters from mid-January to September. Bay circulation is driven by offshore ocean currents; water generally moves into the Bay from the south and out of the Bay from the north with an average speed of 0.1-0.2 knots; however currents are more sluggish in the north and south extremities and in near shore areas. Surface waters from Central Monterey Bay moving to the northern Bay require three to ten days transport time. A clockwise gyre usually occurs in the southern "pocket" of the Bay where currents average 0.05 knots. There appears to be a counter clockwise gyre in the north Bay. Winds play a dominant role in surface water circulation; predominant winds are northwesterly from April to September and trend north-northeast during the rest of the year. Additional information on Monterey Bay currents and hydrography is included in Chapter 11 and in AMBAG reports.

Nutrients appear evenly distributed throughout the Bay, although higher values appear near shore and in the north and south pocket areas. Ammonia nitrogen was consistently high in the "south pocket" in the Monterey-Seaside area. Phytoplankton numbers did not appear to increase with nutrient levels although chlorophyl concentrations were typically higher at inshore stations than offshore, possibly due to the upwelling influence. The dinoflagellate, Gonyaulax sp., appeared in bloom proportions in September and October when waters are warmer, replacing the variety of diatom species which dominated the phytoplankton from winter through mid-summer. The waters of Soquel Cove in the north pocket and Monterey Harbor in the south are highly productive in late summer when circulation is reduced; accordingly these areas are very sensitive to artificial nutrient inputs during the summer as the waters warm and support dinoflagellate blooms. The sensitivity of Monterey Bay waters to wastes as related to factors discussed above is indicated in Fig. 6-3.

The inland areas around Monterey Bay support an extensive agricultural economy, particularly in the lower Pajaro and Salinas River Valleys. Predominately truck crops are produced in these areas, particularly artichokes in the cool summer coastal belt and lettuce and other vegetable crops inland around Salinas. The Salinas Valley is renowned for its high quality agricultural produce.

Inland areas around Monterey Bay were also evaluated in terms of sensitivity to wastewater disposal on land. Sensitivity of lands in the Monterey Bay Region is depicted on Fig. 6-4; this figure identifies urban, recreational and agricultural areas and locations of soils considered appropriate for wastewater disposal to land by percolation or irrigation. A further discussion of land disposal as it pertains to underlying groundwaters is provided later in this Chapter.

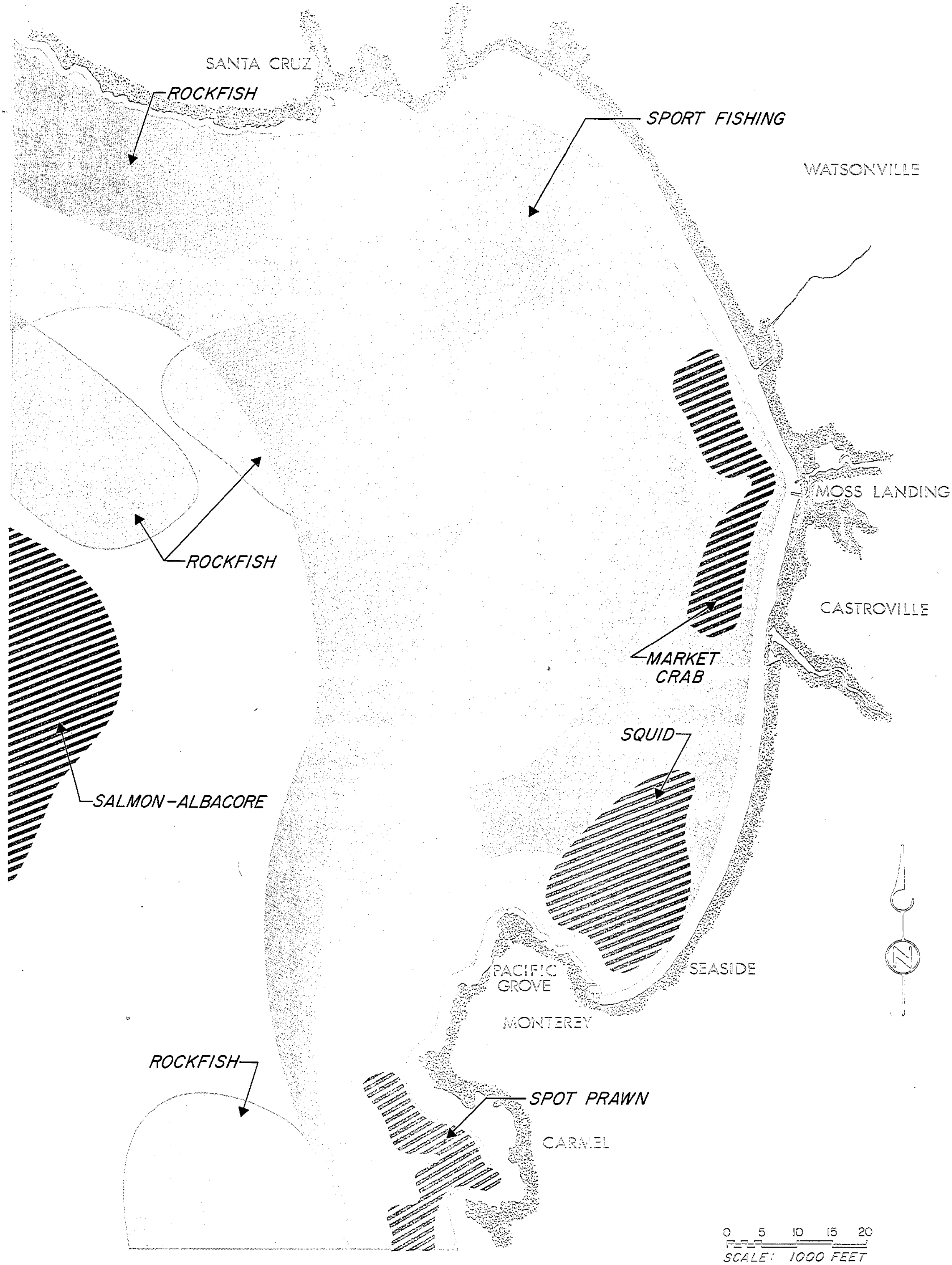


Fig. 6-1 Important Fisheries of Monterey Bay

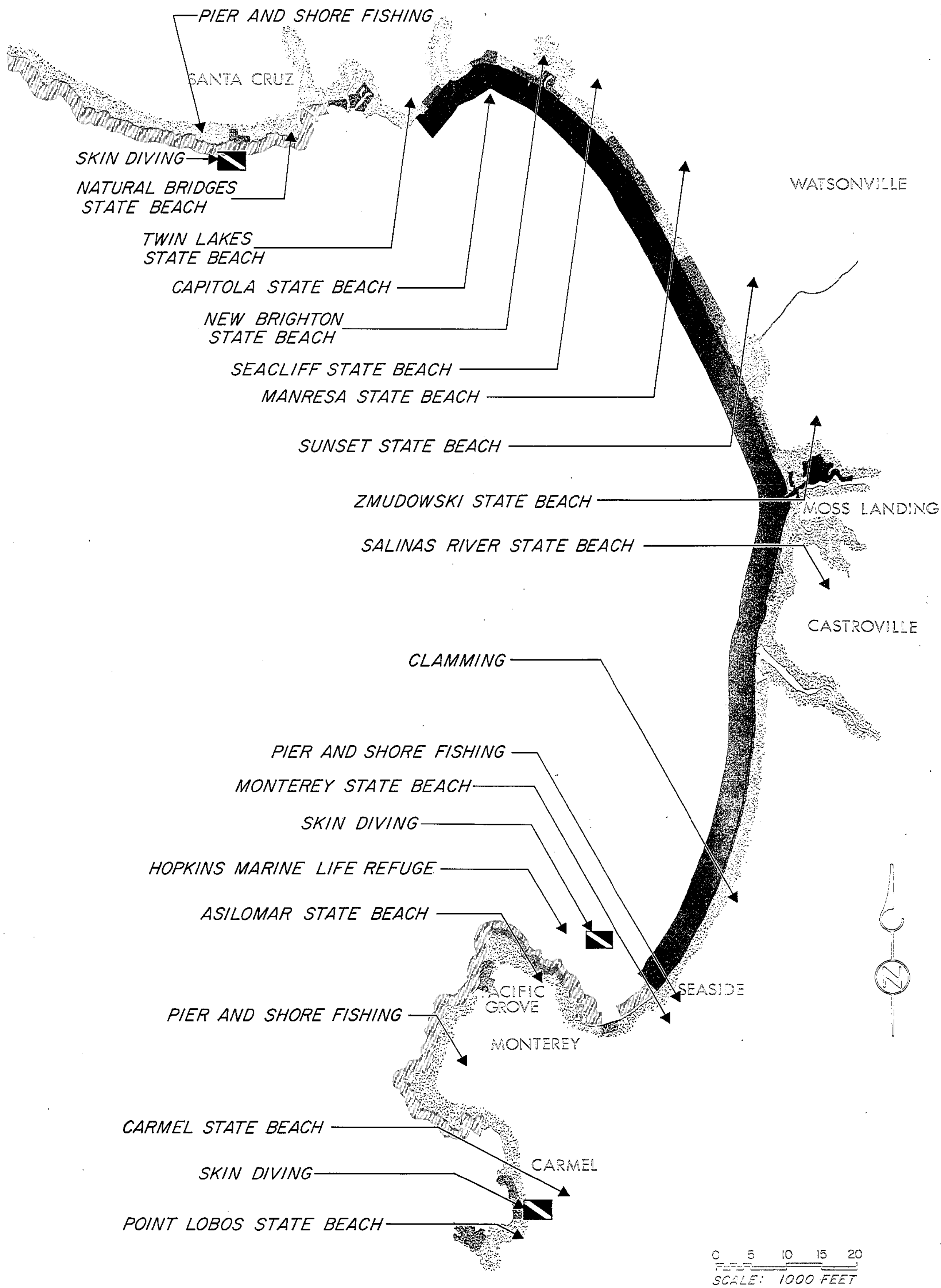


Fig. 6-2 Important Recreation Areas of Monterey Bay

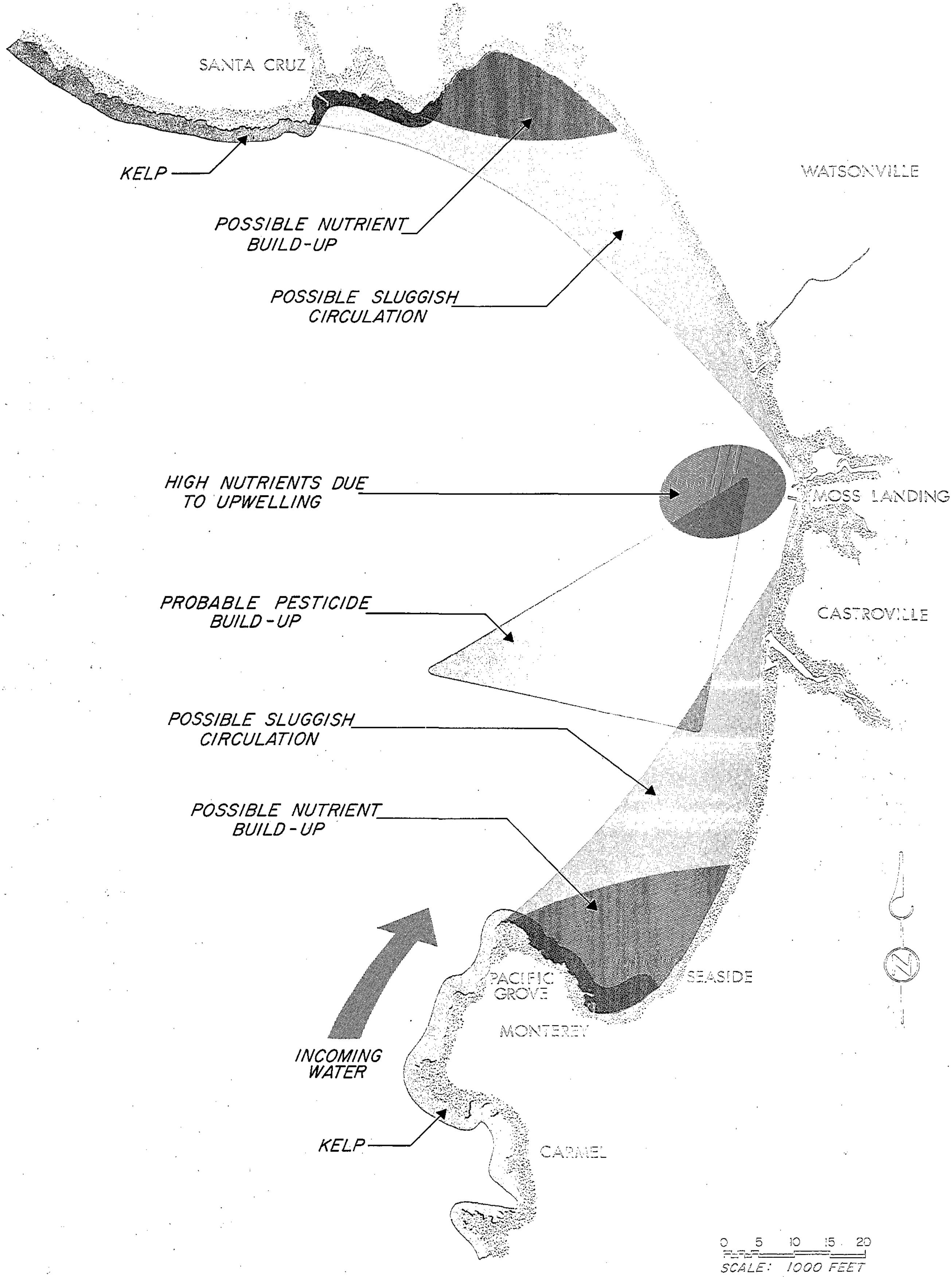


Fig. 6-3 Sensitivity of Monterey Bay to Waste Discharges

Carmel Bay

To the south, across the scenic Monterey Peninsula is Carmel Bay, a complex body of water about 1/50th the area of Monterey Bay. Although smaller, current patterns are as complex as in Monterey Bay. Upwelling from a deep submarine canyon occurs more consistently than in Monterey Bay; accordingly nutrient values are higher. Residence time of waters, and by analogy wastewaters, is much shorter in Carmel Bay; tidal currents are strong such that flushing is viewed in terms of hours whereas in Monterey Bay, comparable movement requires days to transport waters or water borne pollutants from the Bay.

Carmel Bay is utilized for sports fishing but receives higher acclaim as a nearshore skindiving area. Monastery Beach at the head of Carmel Valley is the most frequented skindiving spot in the area. At the south end of Carmel Bay is Point Lobos State Park where sea lions can be seen on the offshore rocks and wind shaped Monterey Cypress is found.

Kelp beds are fairly prevelant and dense near the shores of Carmel Bay. Major areas are found from Cypress Point to Pescadero Point on the northern shore and along the southern shore from Monastery Beach to Point Lobos.

The inland area around Carmel Bay and eastward along the Carmel River is urbanized; however some areas have been identified as having potential for wastewater disposal or for irrigation reuse. These areas are shown on Fig. 6-4.

Upper Salinas River Area

Inland areas of the upper Salinas River system were evaluated in terms of land disposal sensitivity since this portion of the watershed requires more careful planning than the flat, predominantly agricultural valley area. Recreational uses are located in this area south of Atascadero and west of Camp Roberts in the Nacimiento Reservoir Recreation Area. Urban and agricultural lands, recreational areas and location considered acceptable in terms of topography and soils. for wastewater disposal are shown on Fig. 6-5.

San Luis Obispo Coastal Area

The coastal area from Morro Bay to Pismo Beach inland to the City of San Luis Obispo includes a variety of specialized habitats and resources. These are described in a general way in the upper three maps shown on Fig. 6-6. The first map depicts wildlife resources and their habitats; these include the Morro Bay water fowl habitat which supports the endangered brown pelican, the habitat of the endangered kangaroo rat, various riparian habitats and the kelp beds along this coast which are favored spots for coastal birds, sea lions and harbor seals. The second map shows the fin fisheries of this area which include inland trout and anadromous fish streams, grunion spawning areas, bottom fisheries and the kelp associated fisheries such as rock fish and ling cod. The third resource map includes shellfish, recreational use and archeological sites such as Indian burial grounds. Notable among these resources are the abalone, pismo clam areas of the coastal reach and oyster and clam beds within Morro Bay.

Wastewater disposal sensitivity of the land and aquatic environments of this area were assessed with a consideration of the above resources and various physical constraints such as flood zones, urban land use, soil infiltration and topographic slope. These constraints are identified geographically in the lower three maps on Fig. 6-6. An analysis of environmental sensitivity conducted with all of these characteristics was used to evolve three levels of sensitivity to waste water disposal to land or surface water; this environmental sensitivity map is shown in Fig. 6-7.

Santa Maria Valley Area

Wildlife and fishery resources, recreational areas and archeological sites for the Santa Maria Valley and coastal area north to Pismo Beach are shown on Fig. 6-8; these resources were identified geographically to facilitate wastewater management planning. The first resource map shows location of kelp beds, coastal wetlands and riparian habitat as well as upland areas which support wild turkey, black bear and the endangered California Condor. The more sensitive habitats in this coastal reach include kelp areas and wetlands which support the California Least Tern, an endangered species. The second map shows fin fishery resources including warm water fishery habitats in coastal streams and in the lower Cuyama and Sisquoc River and Twitchell Reservoir; offshore fisheries are predominately salmon, rockfish and sandy bottom fisheries. The third map illustrates shellfish habitat, predominately pismo clam, abalone, and market crab and recreational areas which include skindiving, clamming and camping. Archeological sites are concen-

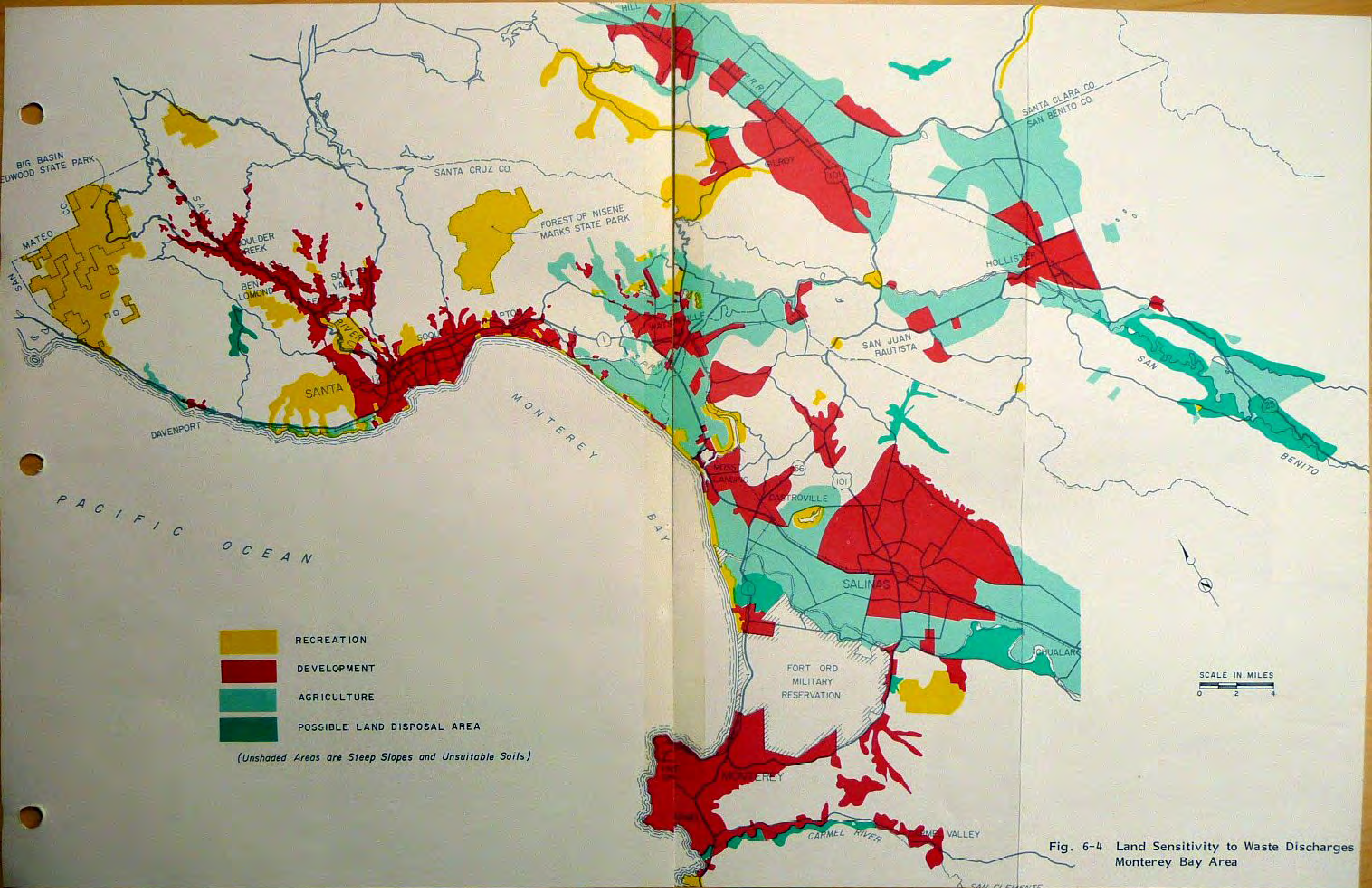


Fig. 6-4 Land Sensitivity to Waste Discharges Monterey Bay Area

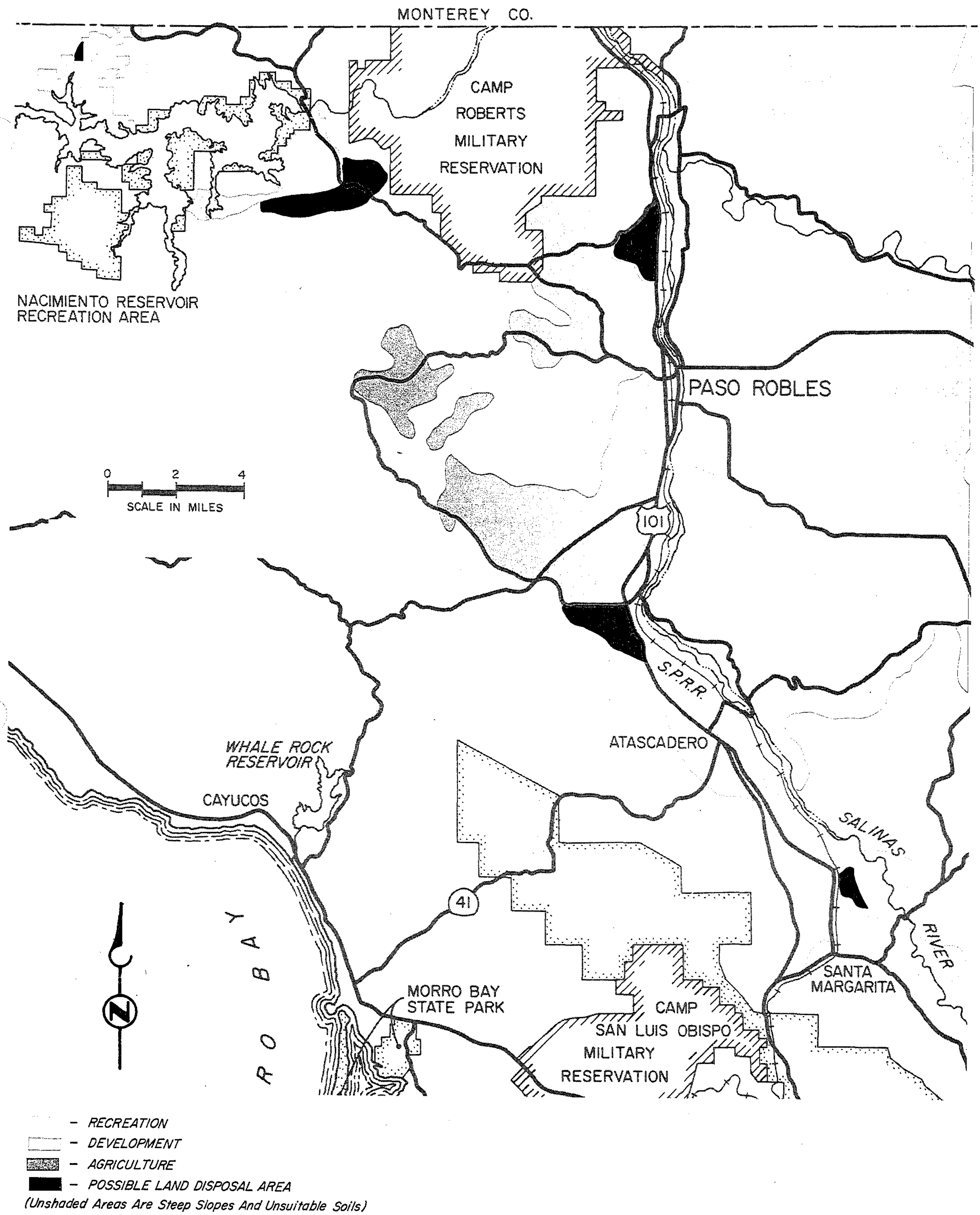
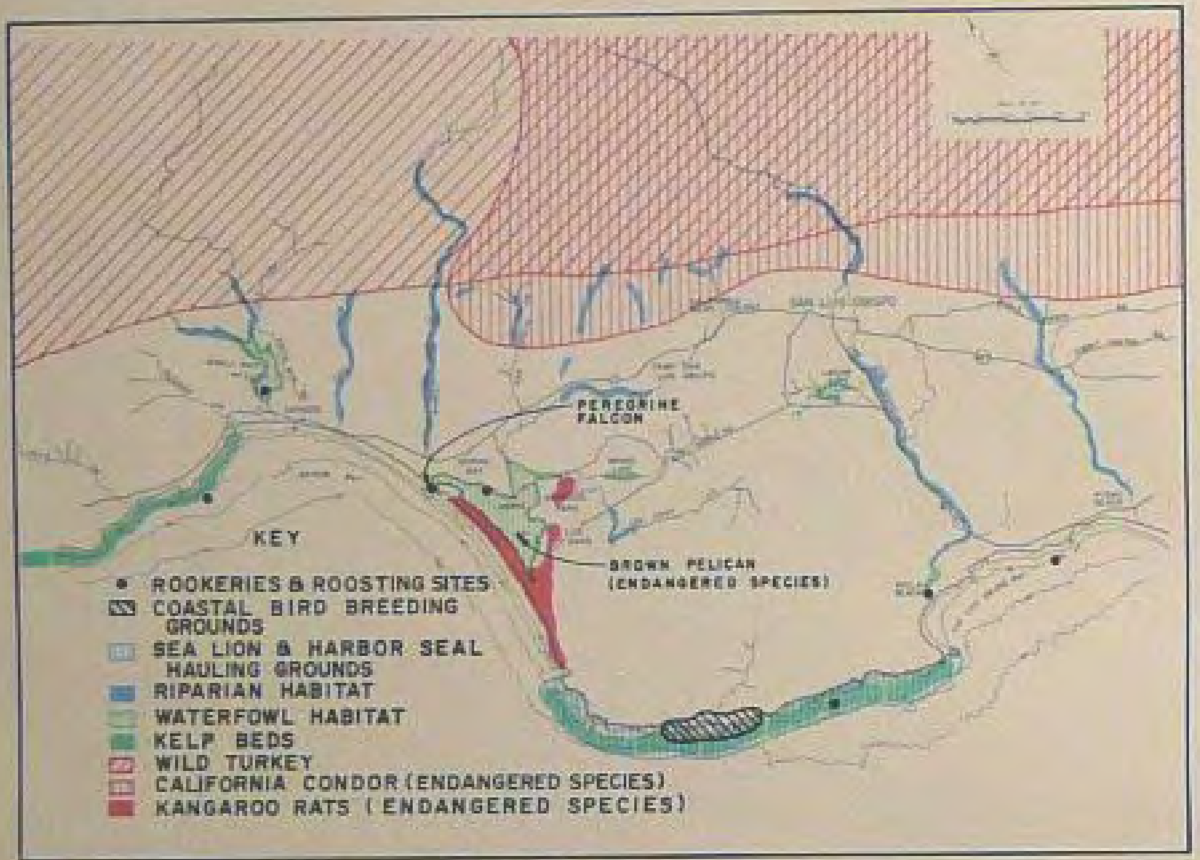
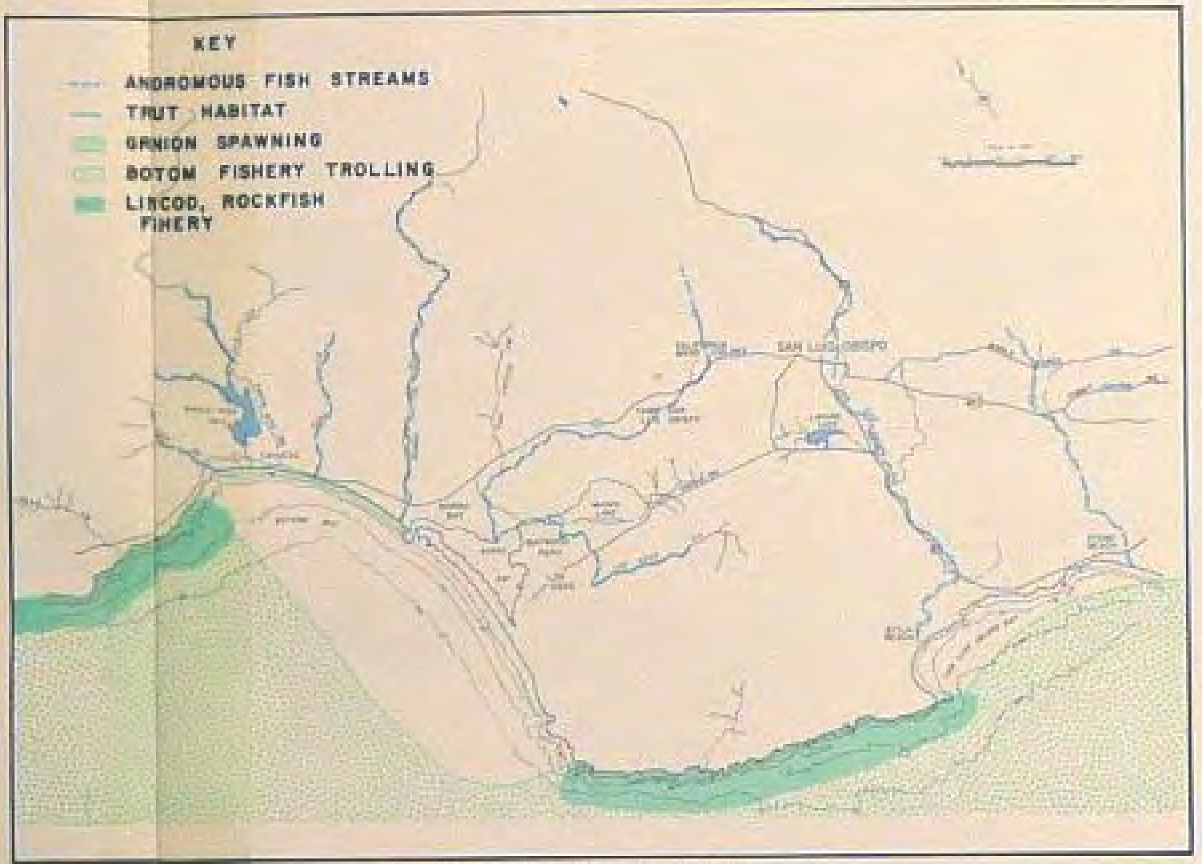


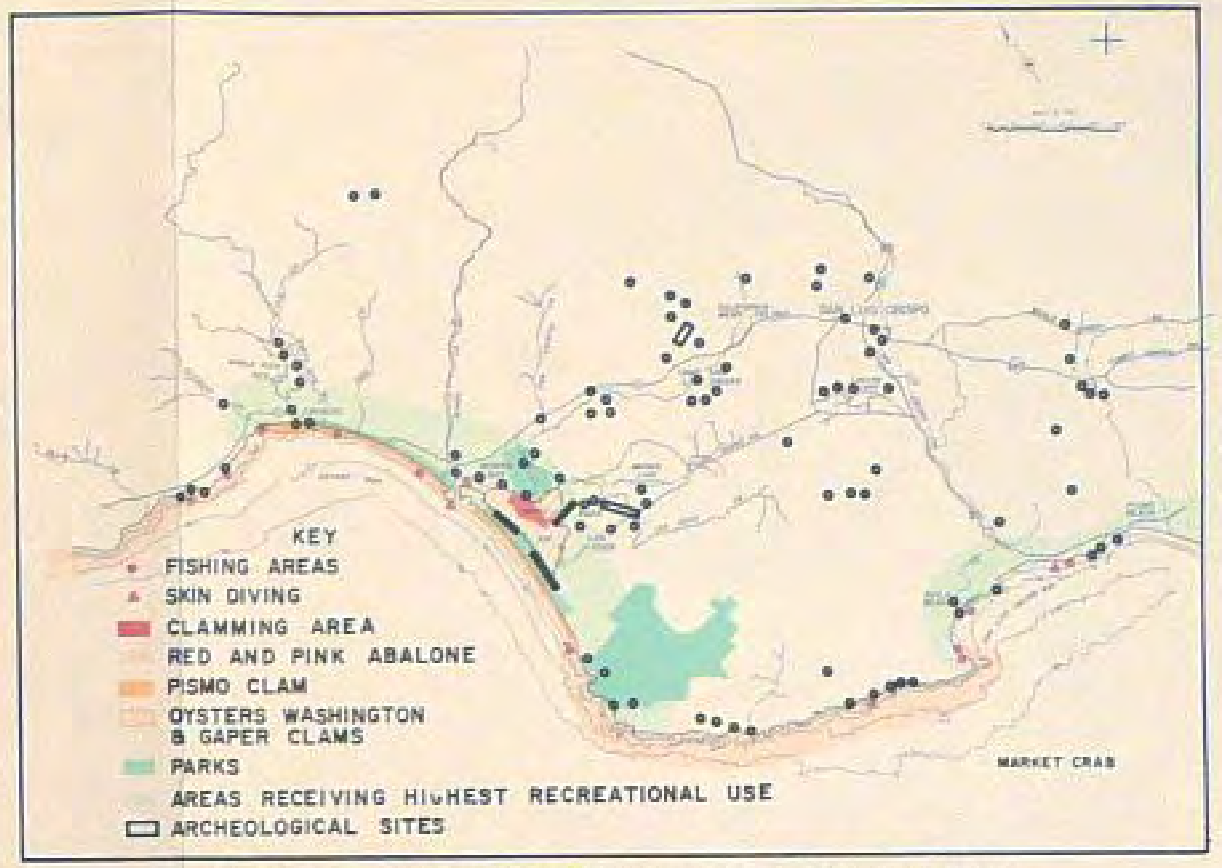
Fig. 6-5 Land Sensitivity to Waste Discharges
Upper Salinas Valley



Wildlife Resources



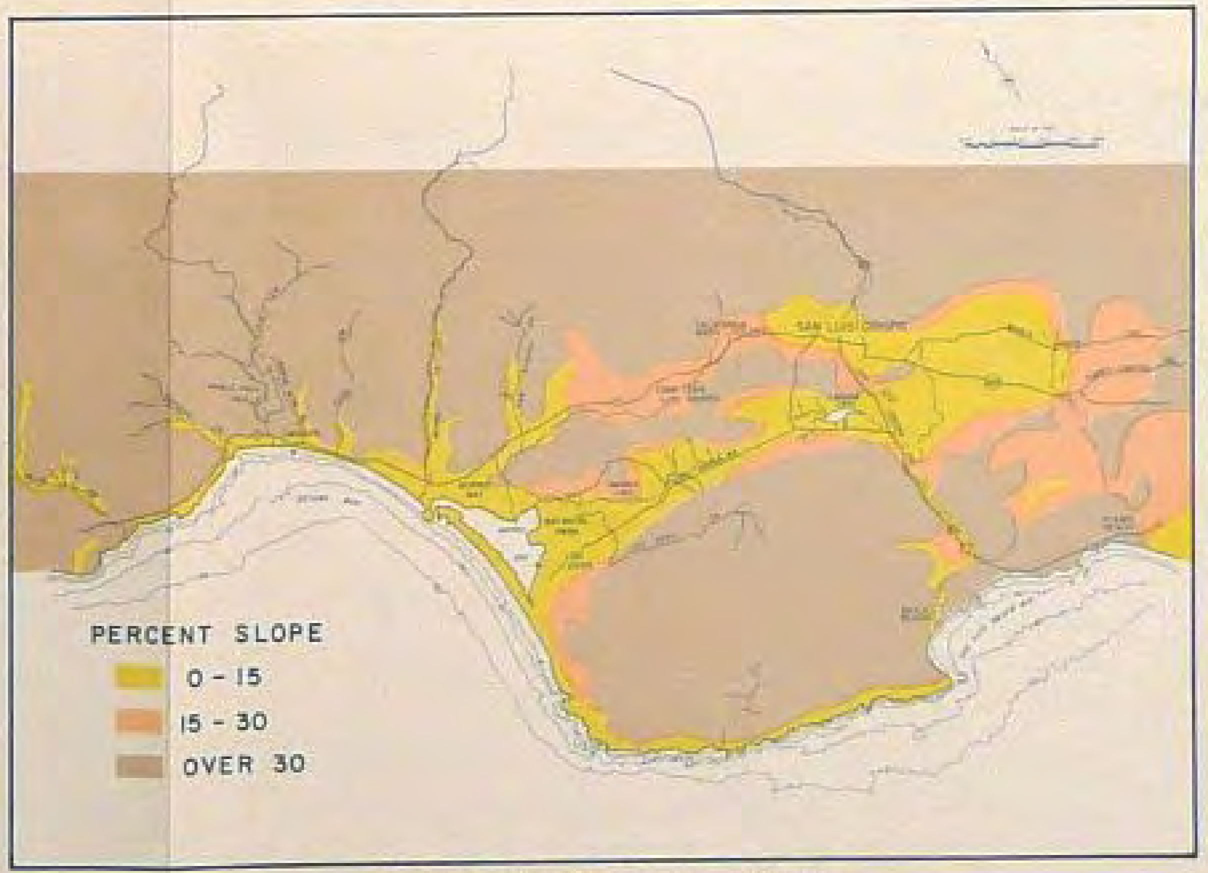
Fin Fishery Resources



Shellfish, Recreational Use and Archeological Sites

Flood Hazards and Urban Areas

Soil Infiltration Rates



Topographic Slope Variations

Fig. 6-6 Environmental Resources and Constraints San Luis Obispo Coastal Area

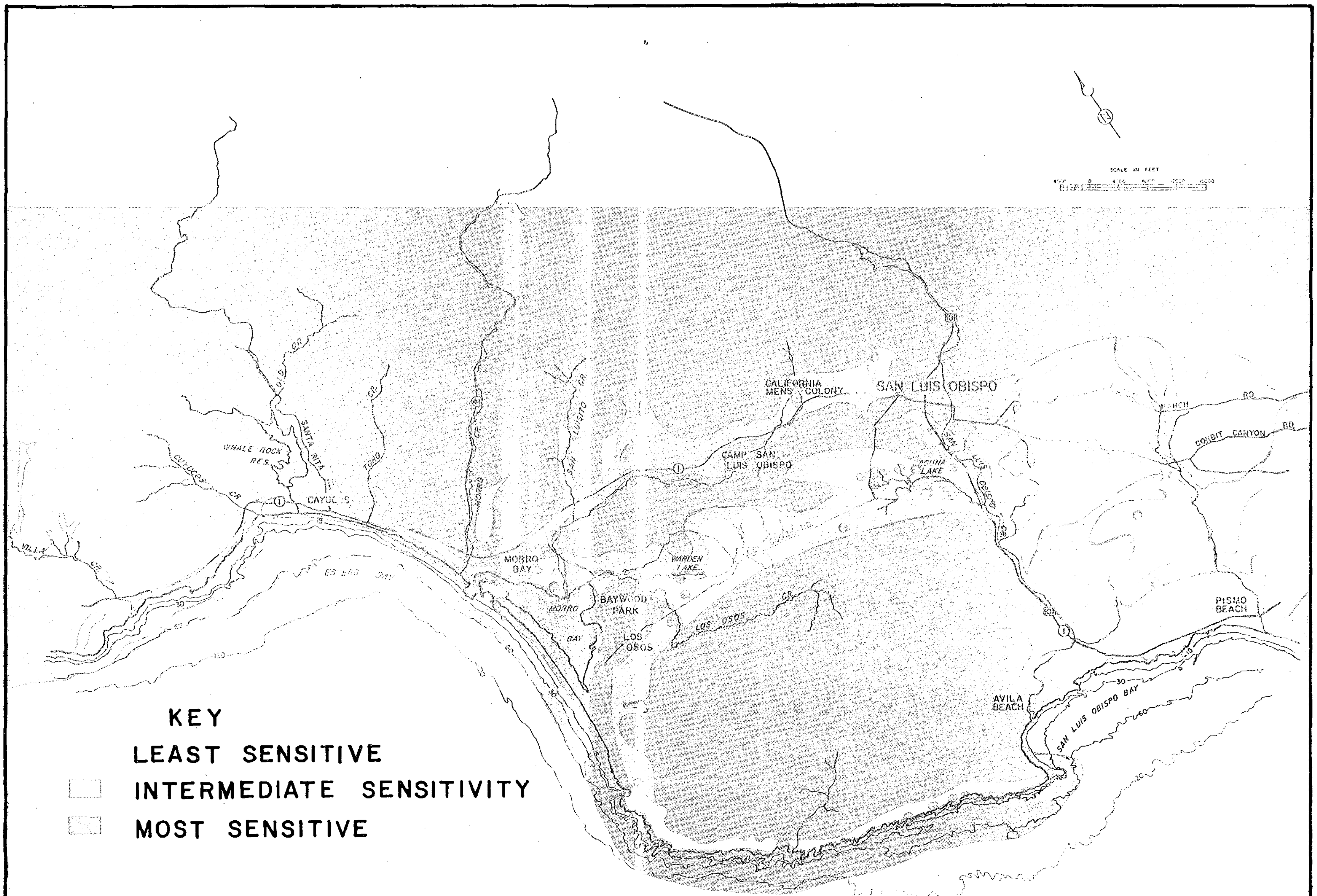
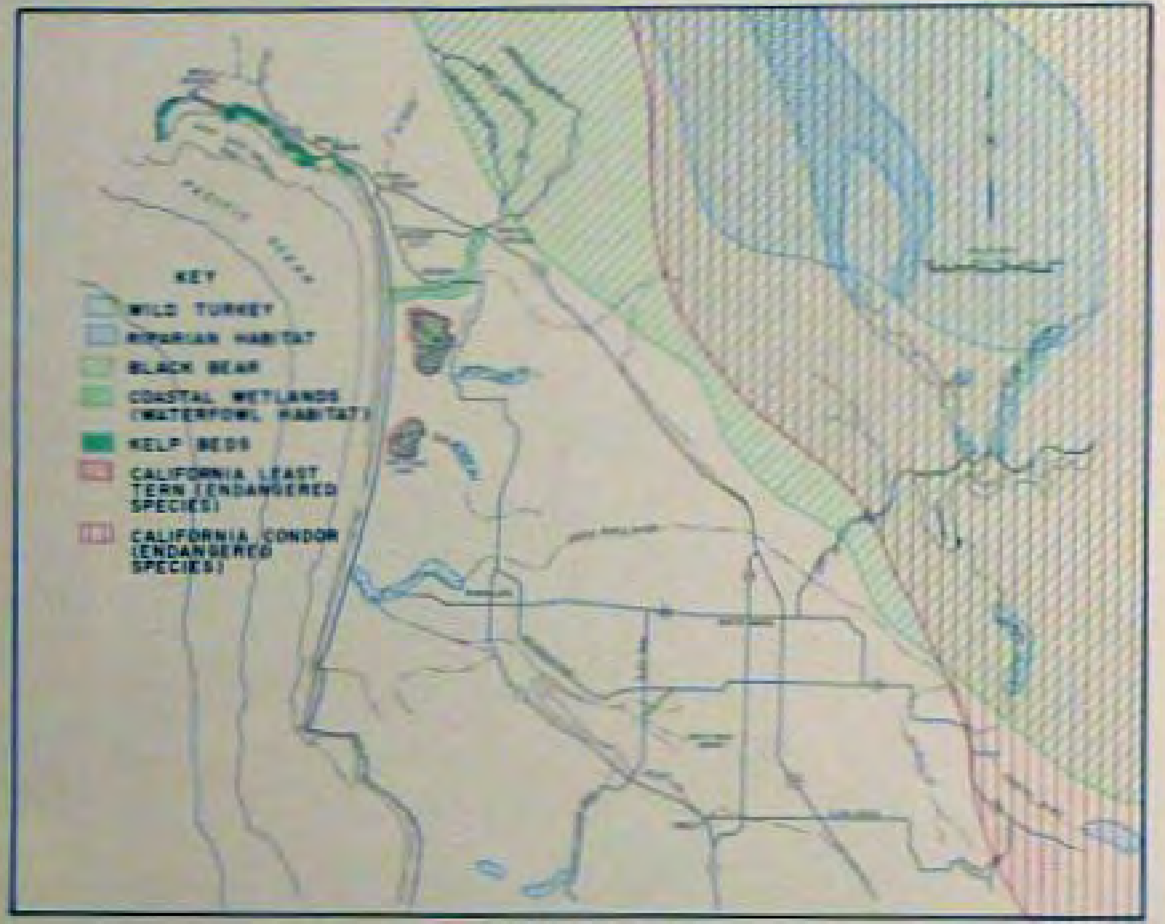
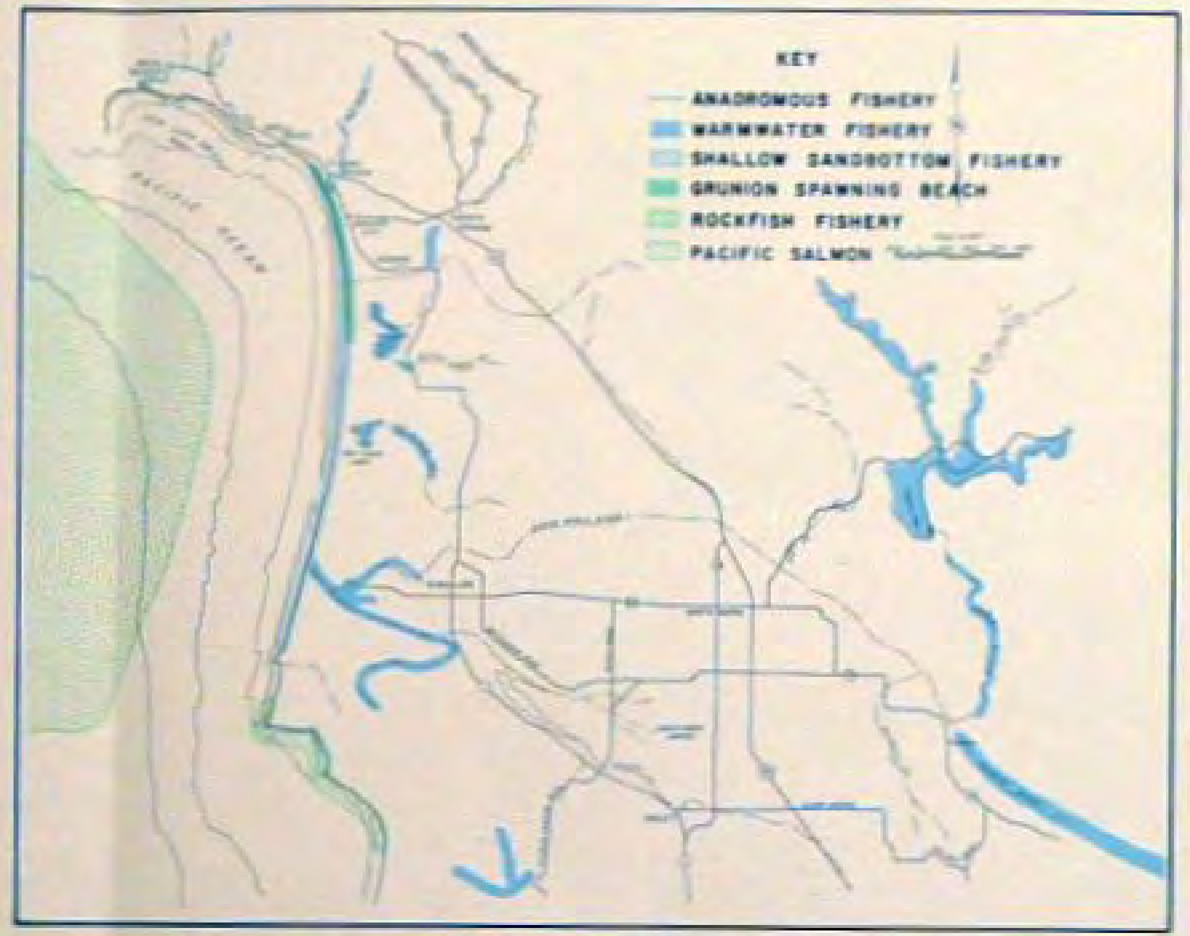


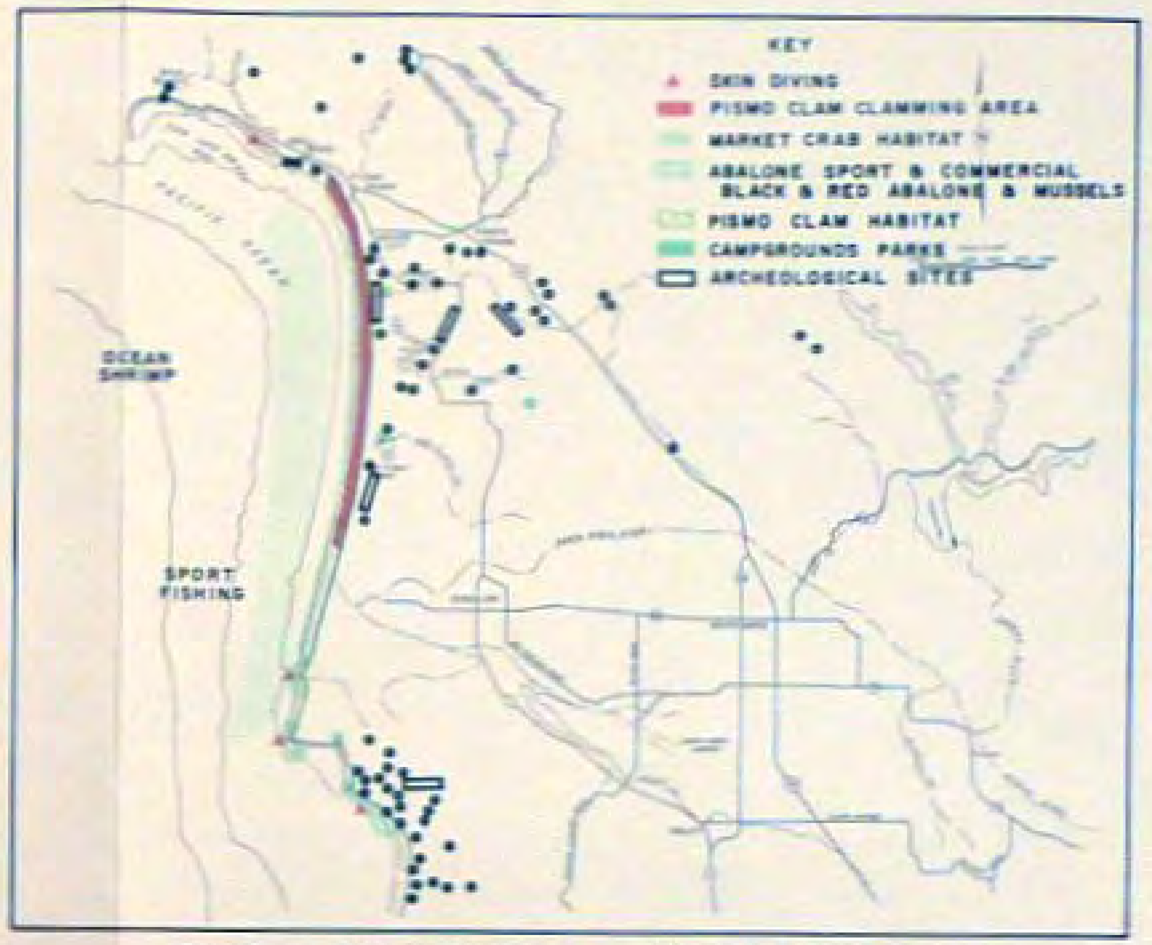
Fig. 6-7 Environmental Sensitivity San Luis Obispo Area



Wildlife Resources

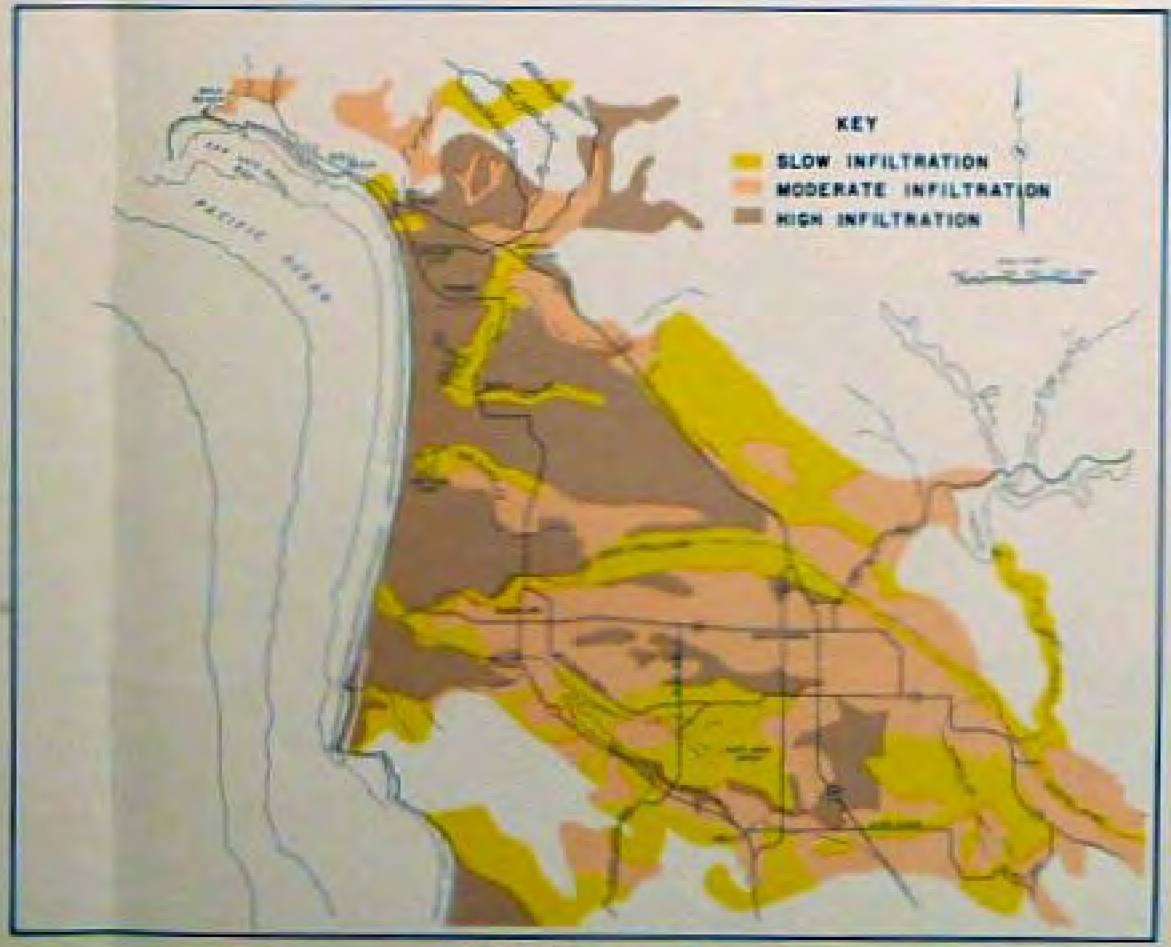


Fin Fishery Resources

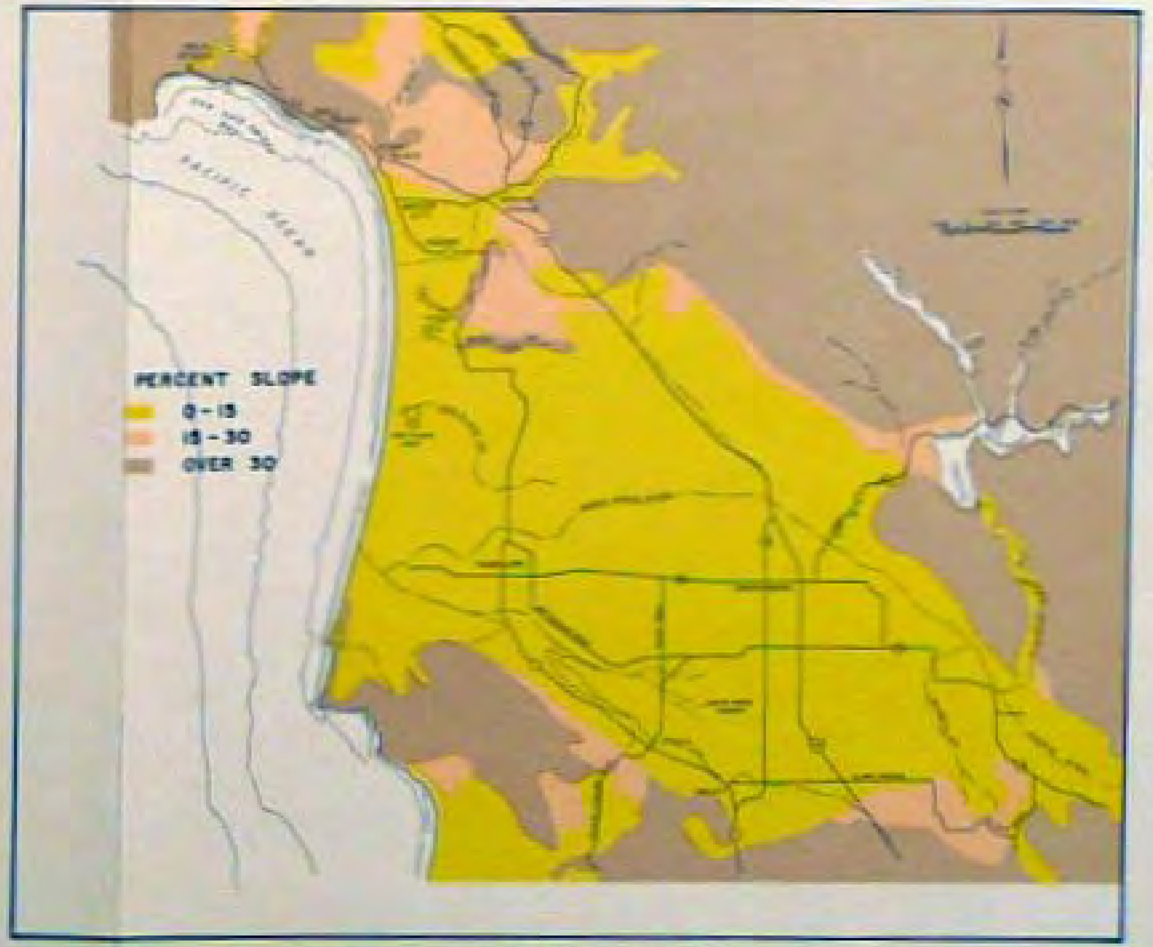


Shellfish, Recreational Use and Archeological Sites

Flood Hazards and Urban Areas

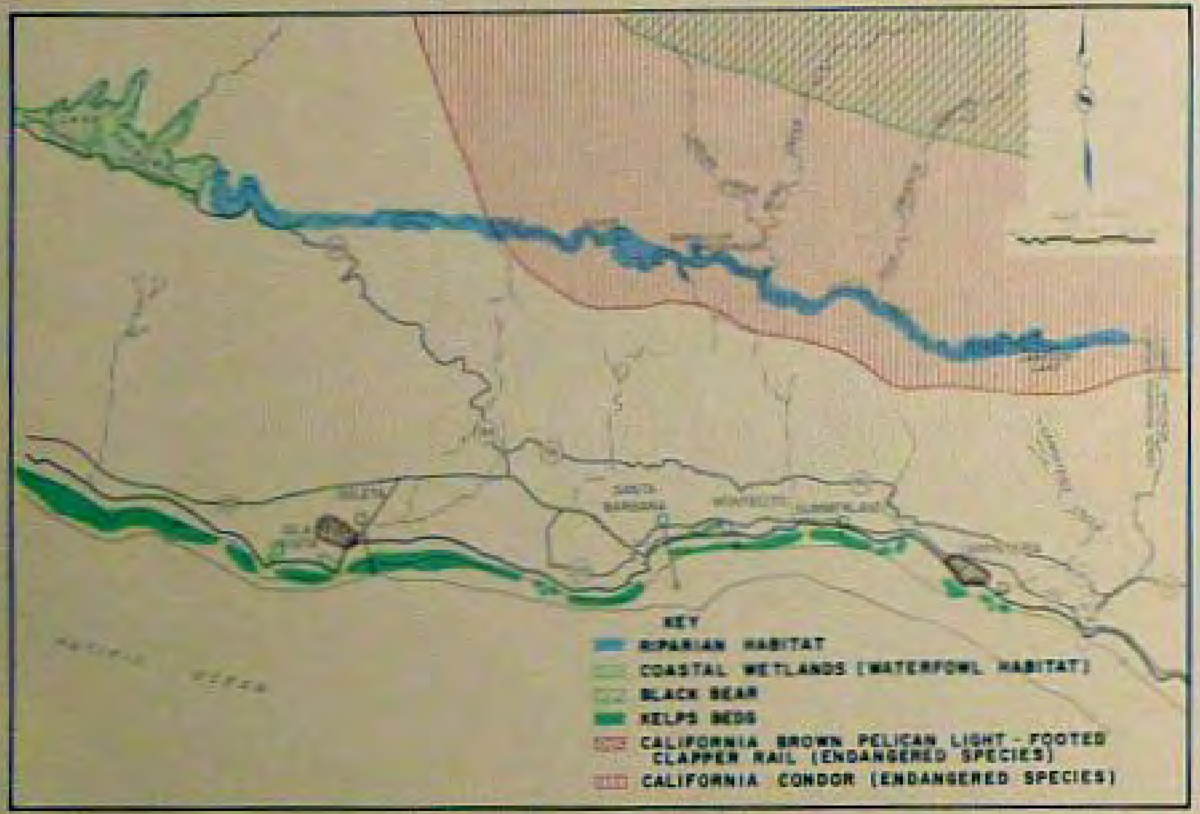


Soil Infiltration Rates



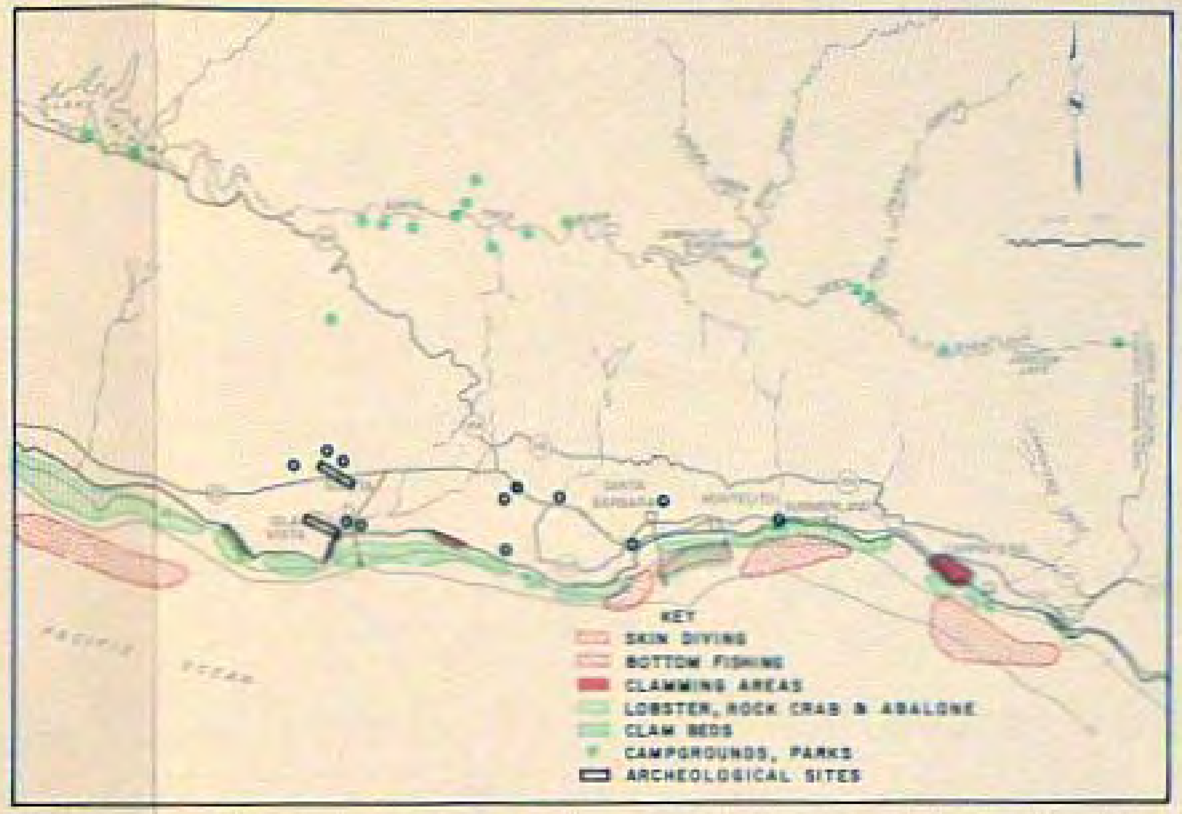
Topographic Slope Variations

Fig. 6-8 Environmental Resources and Constraints Santa Maria Valley Area



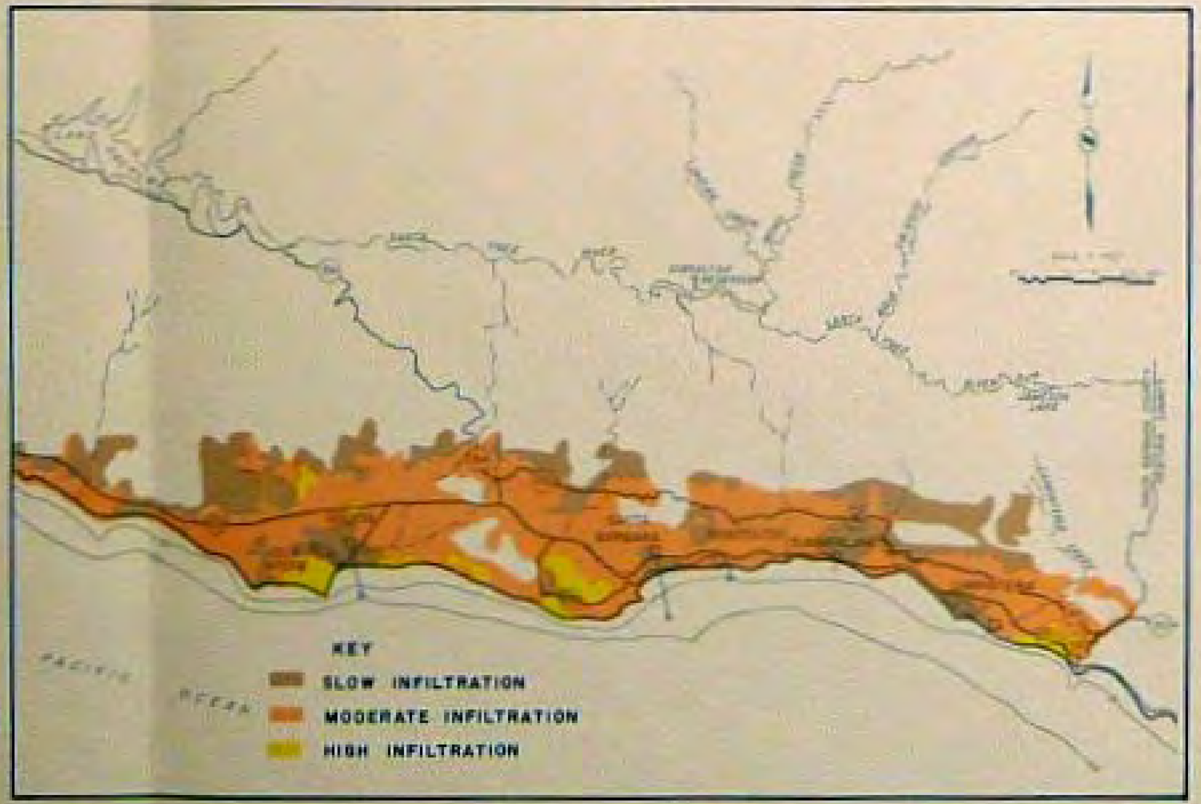
Wildlife Resources

Fin Fishery Resources

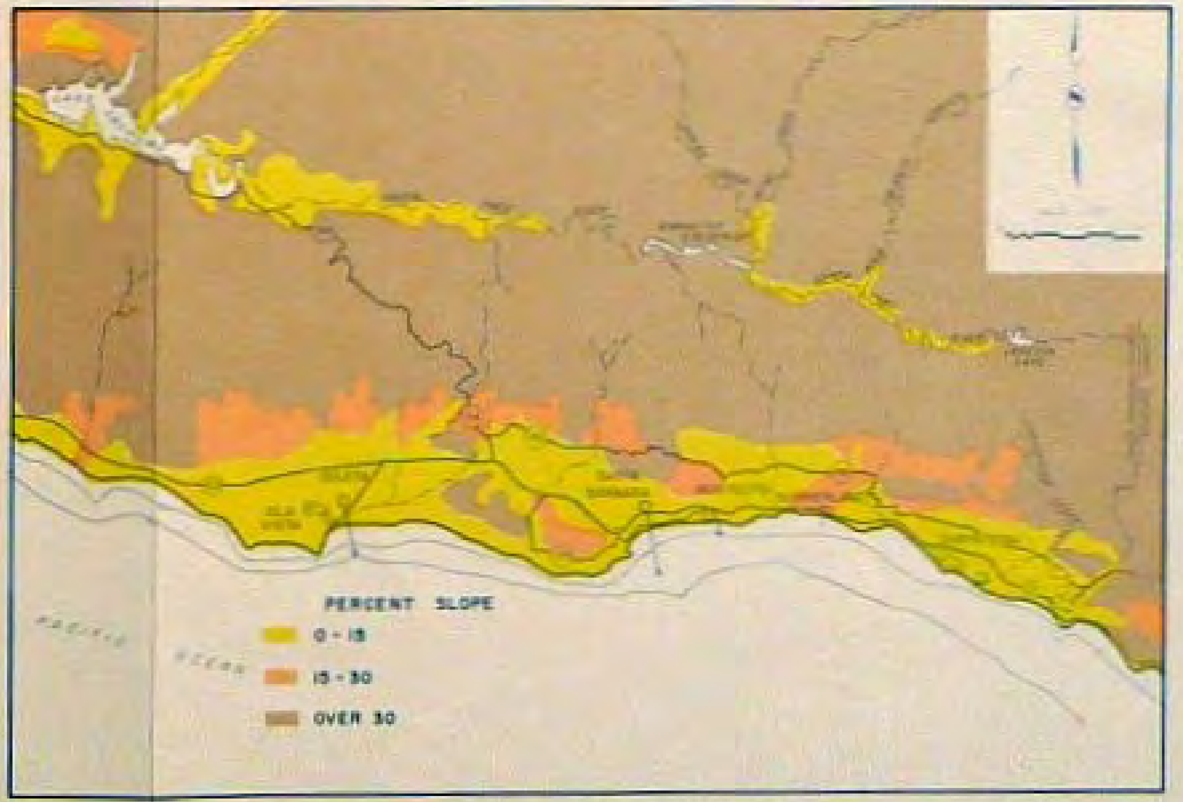


Shellfish, Recreational Use and Archeological Sites

Flood Hazards and Urban Areas



Soil Infiltration Rates



Topographic Slope Variations

Fig. 6-9 Environmental Resources and Constraints
Santa Barbara Coastal Area

trated in the coastal area and include Indian burial mounds.

Physical factors used to evaluate environmental sensitivity include flood prone areas, urban lands, soil infiltration and topographic slope variations. These are shown on the lower three maps in Fig. 6-8. As with the previous areas this information can be synthesized to identify environmental sensitivity to wastewater disposal. Agricultural areas, not shown on these maps, predominate in the Santa Maria Valley area and are located around the urban centers. The sensitivity of the inland area to wastewater disposal is relatively low in the agricultural areas, so long as groundwater quality is protected. The highly mineralized groundwaters underlying this valley have been identified as the most sensitive aspect affecting wastewater disposal practices.

Santa Barbara Coastal Area

Environmental resources and constraints of the coastal waters and terraces of the Santa Barbara Coast and the upper reaches of the Santa Ynez River which supply water to this urbanized area are shown on Fig. 6-9. Wildlife resources shown on the first map in the upper part of this figure include kelp habitats and coastal wetlands which support the endangered brown pelican and the Light-Footed Clapper Rail; upland areas include the endangered California Condor and black bear. Fin fisheries include halibut, sea bass and grunion spawning; whereas inland areas include mixed warm and cold water associated species in Lake Cachuma and trout in the upper Santa Ynez River. Shellfish are extensive in the coastal waters of this reach which are warmer than the other parts of the central coastal waters due to influence of the counter current of the Santa Barbara Channel which bring in warmer waters from the south; shellfish resources include lobster, rock crab, abalone and clam beds along the entire reach. Recreation is extensive including swimming, skin-diving, surfing, clamming and camping. Archeological sites are relatively few in number.

Physical constraints to wastewater disposal are associated with extensive urban growth along the coastal terrace and steep topography inland. The three maps shown on the lower portion of Fig. 6-9 depict urban land use, flood prone areas, soil infiltration rates and topographic slope. Because land use and slope constraints have eliminated most land from consideration for wastewater disposal, the most acceptable disposal mode for municipal wastewater in this coastal reach is ocean disposal after treatment and effective source control of cumulative toxicants: Outfall and diffuser systems must comply with dilution requirements of the State Ocean Policy. Other sensitive aspects of this area pertain to urban runoff effects on quality of local coastal waters.

ENVIRONMENTAL IMPACT ASSESSMENT

Implementation of the recommended water quality management strategy will produce certain environmental, social, and economic impacts. At the basin planning level, only broad categories of potential impact are identifiable. Potential problem areas which will require additional future study are pointed out. Detailed analyses of environmental impact will be done in the future at the local project level. At that time, more detailed information will be available regarding the required project facilities, specific site requirements, projected effluent quality, local environmental conditions, etc. Portions of this project analysis could precede development of project plans to ensure that minimum impacts are imposed.

Attention, in this chapter, is directed primarily toward the long-term effects of implementing the recommended plan. Impacts covered include not only the direct effects (i.e. the immediate results of an action) but also indirect effects. Emphasis is placed more upon a description of the nature of the potential impacts than on determining relative magnitudes of impacts. Such a determination will be appropriate at the project planning level. Foreseeable short-term impacts which are likely to occur during construction phases are listed below. A detailed analysis is not appropriate at the basin planning level because specific facility siting and routing decisions have not been made and control programs for non-point sources of pollution have not yet identified specific construction components. Typical short-term impacts common to construction projects associated with sewerage utility improvements include:

Disruption of traffic patterns and creation of traffic hazards.

Distruption of land uses on and adjacent to rights-of-way.

Disruption of utility services.

Distrubance and compaction of soil.

Disturbance and destruction of flora and fauna.

Distrubance and destruction of residential landscaping.

Creation of dust, fumes, noise and vibration.

Creation of safety hazards.

Creation of visual impacts.

Economic activity induced by land and materials expenditures.

Creation of employment opportunities during construction.

Short-term impacts will be discussed further where major sewerage facility consolidations or other major changes involving construction are envisioned.

Long-term effects may be questioned concerning discharges from point sources, whether to surface waters or to land. Each method requires consideration of pollutant effects which may result and mitigating measures for such effects. A general discussion of impacts associated with these disposal modes is offered to acquaint the reader with principal issues; additional details are included in Chapter 16.

Regarding discharges to surface waters, most of the cases encountered in the Central Coastal Basin involve ocean disposal; the few stream disposal cases (e.g., San Luis Obispo and Lompoc) are described with the sub-basin impacts. Ocean disposal will require secondary treatment and discharge through outfall and diffuser systems which provide at least 100:1 dilution 50 percent of the time and 80:1 dilution at least 90 percent of the time. Specific controls on toxic metals and pesticides which may persist and accumulate in aquatic life are provided for in specific conditions of the State Ocean Policy and the Federal Water Quality Control Act. Pollutants of major concern in ocean discharges are contaminants such as pathogenic bacteria, toxicants, floatables and other aesthetic factors whereas pollutants affecting oxygen resources generally exhibit less impact in view of dilution provided. Biological response to outfall discharge is a major concern and careful site studies are needed to ensure waste discharge is not in a sensitive habitat. For example, discharges near a fish nursery area or near a kelp bed is undesirable whereas discharges to waters overlying an extensive sandy bottom are of less concern. Treatment with disinfection and source controls of such troublesome pollutants as toxicants and oils is required to mitigate adverse effects of water quality factors not eliminated by dilution. Similarly, monitoring, including biological studies, is necessary to establish presence or absence of changes or damages to marine life.

Disposal to land whether as irrigation water or by percolation to groundwaters raises different water quality control questions from those described above. Major impacts are associated with mineralization of groundwaters, addition of nitrates and constituents of public health concern such as described in State Health Department guidelines relative to reclamation described in Chapter 5. Non degradation is a particular concern since rehabilitation of groundwaters is a lengthy process, if feasible. Recommended wastewater disposal programs involving percolation are described for many areas of the Basin, examples include the Gilroy and Hollister areas of the Pajaro River sub-basin, inland areas of the Salinas River sub-basin, the Morro Bay area, the Santa Maria Valley, and the upper Santa Yzez region. In most of these areas salt source control is a part of the recommended plan, this aspect of pollution control is discussed in some detail in Chapter 16. Measures available to reduce the salt content of wastewater effluents include control of water softener brine discharges to sewers as well as highly mineralized industrial wastes; although this can be attempted by ordinance, there is need in some communities to reduce mineral content of the water supply. This can be accomplished by lime soda softening or parital demineralization of existing supplies or by water supply source changes. Salt source control measures thus can be tailored to reduce mineral increments and the total dissolved solids (TDS) of the water supply. Other measures are available to reduce the impact of effluent disposal on groundwater quality; including nitrate removal, demineralization of a portion of the flow to blend the effluent to a lower TDS and dilution of percolating waters. The salt source control programs should be pursued first and necessary treatment should follow suit if degradation of groundwater quality is threatened. In some areas geologic conditions may indicate percolation disposal sites should be located across fault zones separating groundwaters of differing qualities.

The Hollister area and the Los Osos area are believed to have geologic conditions of this kind.

Here siting of percolation beds should be over the more highly mineralized groundwaters in order to protect the better quality groundwater basin. Geologic investigations can be used to mitigate environmental problems due to effluent percolation and may influence the final decision on treatment necessary to prevent groundwater degradation.

Irrigation techniques can be used seasonally to maximize vegetative uptake of nutrients, particularly soluble nitrates, and to substitute effluents for groundwater pumping in some areas. This approach is encouraged in the Salinas Valley and the region around Morro Bay. Spray irrigation will be the disposal mode in many communities in the dry season while percolation will be the predominant method of land disposal in the wet season for most of the municipal systems utilizing land disposal in the Central Coastal Basin.

Energy use is a long-term impact related to most of the recommended plans, both in the direct sense for operations and energy used in the mining, processing or transport of chemicals. Direct electrical power consumption in municipal wastewater treatment is relatively minor when compared with other uses. For example, recent studies by the Environmental Protection Agency indicate typical per capita residential use of power of about 5 kilowatt hours (kwh) per day as compared with 0.05 kwh per day for operation of conventional secondary municipal wastewater treatment facilities. Furthermore, residential power use represents less than 30 percent of the national totals; most power consumption is for industrial and commercial use. Electrical power for municipal wastewater treatment is currently about one percent of the average residential power consumption. This relationship will change as treatment plants are upgraded.

Indirect energy use as for mining, refining and transporting chemicals (particularly chorine used in effluent disinfection) is substantial. Estimates vary; however, indirect energy use appears to be at least double the direct energy consumed by secondary or more advanced treatment facilities. Direct electrical power use will increase about fourfold from primary to secondary treatment and between two and threefold from secondary to tertiary treatment employing nutrient removal and effluent filtration, based on EPA findings. Since the shortage of energy is an increasing source of concern, this feature constitutes an adverse impact though admittedly minor except for plans which require more than secondary treatment. Plans which involve substantial energy costs for pumping effluent to land disposal sites also register adverse impacts and in coastal areas ocean disposal options may be more cost-effective.

Long-term impacts of the recommended plan are described according to the format of the National Environmental Policy Act and the California Environmental Quality Act. Assessments are divided by sub-basin and topic to facilitate review. Municipal sewerage facility plan impacts are described by sub-basin sequence; environmental impact of other aspects of the plan, such as management of industrial wastewater, individual disposal systems, and construction, mining and logging activities, are described in a separate discussion.

Santa Cruz Coastal Sub-Basin

Environmental impacts for the Santa Cruz Coastal Sub-basin sewerage facilities are minor ones associated with three small separate treatment plants and their disposal operations; these facilities are at Davenport, Big Basin State Park and Ben Lomond. Beneficial and adverse environmental impacts associated with recommended plans for these facilities are:

1. Retention of separate sewerage facilities at Big Basin State Park and Ben Lomond C.Y.A. minimizes the impact of interceptor sewer and pumping station construction and the aggregate effect of a large discharge high in the watershed.

2. A small direct stream discharge from Big Basin State Park (0.04 mgd) to Waddell Creek will be eliminated unless stream flow benefits can be accomplished with upgraded treatment. Enhancement of Waddell Creek water quality and dry season stream flow will benefit recreational uses associated with wildlife and fishery habitat including spawning grounds for salmonids.

3. Stream flow enhancement by discharge from Big Basin State Park, after upgraded secondary treatment and disinfection consistent with unrestricted recreational use criteria of the State Health Code, may exhibit adverse impacts associated with drinking water use downstream.

4. Disposal of treated wastewaters to land during the recreational season would reduce stream flow in Waddell Creek at a time when the creek is nearly dry.

5. Elimination of the small near-shore ocean discharge at Davenport (.02 mgd) will have negligible impact on beneficial uses of the local shore which is an inaccessible cliff area.

6. Provision of land diposal and upgraded treatment facilities at Davenport will not involve serious environmental impacts or yield obvious benefits; however, local implementation will involve serious financial hardship.

7. Air quality impacts, noise emissions, energy use, sludge, and traffic impacts associated with operation of wastewater treatment facilities in this sub-basin are negligible.

The above environmental impacts for Big Basin State Park and Davenport depict tradeoffs which warrant further discussion. The tradeoffs for Big Basin are environmental and relate directly to the impacts of stream flow through discharge of reclaimed water versus the impacts of removing this discharge entirely during the dry season. Stream flow augmentation benefits aquatic habitat and recreation but constitutes a problematical adverse health impact for persons ingesting this water. Upgraded treatment is viewed as a mitigating factor to this health question and was a factor in formulation of this plan. The Davenport tradeoffs are economic and environmental aspects are considered negligible. Accordingly, the mitigating factor is to maintain a low priority for plan implementation since benefits are negligible and hardship is demonstrable. Upgraded treatment and land disposal should be more appropriate as the area grows or as the nearby communities or industries move to consolidate. Secondary treatment could be accomplished in a more cost-effective manner with oxidation ponds.

Local short-term uses of the environment and maintenance of long-term productivity are a factor in the Big Basin and Davenport plans. Should stream discharge from Big Basin State Park prove to be adverse, it can be discontinued in favor of land disposal. The Davenport case may exhibit short-term adverse impacts associated with continued disposal on an inaccessible shore area; however, adverse effects are not documented. Wastewaters are dilute at the point of discharge; consequently, adverse impacts are believed to be inconsequential during any period of delay and reversible on implementation of the plan.

Irreversible and irretrievable committments of resources can be associated with construction of sewerage facility improvements and the committments of energy, chemicals, materials, and finances to implement these plans. In this sub-basin only Davenport registers major concern in this regard due to the financial hardship caused where environmental benefits are at best obscure.

Growth inducing factors do not pertain to the Big Basin Park or Ben Lomond facilities since these are not limited by their sewerage aspects. The Davenport case may be characterized by a negative inducement since local tax burdens caused by plan implementation would probably favor an exodus.

San Lorenzo River Sub-Basin

Environmental impacts of the recommended sewerage facility plans for this sub-basin are varied and complex. Communities affected include sewered and unsewered areas of the San Lorenzo Valley, the City of Santa Cruz and neighboring coastal communities to the east. Major aspects of the plan for this sub-basin pertain to septic tank or sewer feasibility, reclamation for stream flow enhancement and irrigation, interceptor sewer construction and effluent disposal to ocean waters. Beneficial and adverse impacts of the recommended plans include:

1. Problematical adverse effects may result from continued use of septic tank systems in unsewered areas of the San Lorenzo Valley where delay in determining sewerage feasibility is caused by the recommended plan.

2. Beneficial effects should accrue from septic tank management programs in the San Lorenzo Valley area designed to correct failing individual disposal systems, identify problems and to determine sewerage feasibility based on efficacy of septic tank systems and cost and benefit of sewering.

3. Short-term adverse construction impacts are associated with the Scotts Valley interceptor construction as well as problematical long-term growth inducement related factors along the pipeline route; abandonment of a small (0.10 mgd) treatment facility at Scotts Valley is a beneficial aspect of this plan.

4. Adverse effects may result from stream flow enhancement features of the plan for the Upper San Lorenzo River watershed areas which are or

may be sewered; seasonal tradeoffs with irrigation are possible but with resultant reduction in summer stream flows. This dilemma was discussed previously for Big Basin State Park.

5. Problematical adverse effects may result from ocean discharge following interim use of physical-chemical treatment prior to implementation of secondary treatment at Santa Cruz.

6. Short-term adverse impacts of construction are associated with a new ocean outfall off Point Santa Cruz.

7. Benefits to Monterey Bay water quality are accomplished by elimination of short outfalls in the environmentally sensitive "north pocket" area with attendant benefits to recreational beaches and important marine fisheries associated with this area.

8. A new ocean outfall discharging 21 mgd off Point Santa Cruz may disturb ecological balance of local marine life and adjacent shoreline areas. This is a problematical adverse impact in view of treatment and dispersion provided; however, the likelihood of subtle impact cannot be ignored and mitigation measures and site alternatives based on local oceanographic surveys must be available.

9. Consolidation of wastewaters from communities along northern Monterey Bay may affect growth in the coastal zone. This aspect has some negative overtones so long as sewerage utility service is available as a growth accommodation mechanism, yet absence of such service has negative aspects. Views will differ on the environmental nature of this impact.

10. Reclamation aspects of the plan for the coastal areas may not be adequate when compared with alternative programs which direct sewerage facilities toward Watsonville.

11. Treatment plant expansion at Santa Cruz will encroach on Neary's Lagoon.

12. Sludge volumes will be increased at the Santa Cruz plant and disposal problems will be magnified by this increase in terms of processing and transport to acceptable land disposal sites.

13. Air quality impact, noise emissions, and traffic associated with the recommended plans are negligible in the San Lorenzo Valley region and considered beneficial in the coastal zone in view of the consolidation program which will eliminate smaller treatment facilities in developed areas which are less capable of mitigation measures for odor control and noise abatement. Energy use is negligible except for a greater long-term use associated with wastewater pumping.

Mitigating factors are apparent for the adverse impacts identified above; these are principally tied to options retained in the plan. For example item 1 pertaining to the delay in sewering caused by sewerage feasibility studies envisioned for the upper San Lorenzo Valley is mitigated by septic tank management aspects described in Item 2. A better plan will result in the upper valley area as a result of such investigation and stream enhancement features or the irrigation option identified in item 4 can be realized. The more controversial aspects of ocean disposal off Point Santa Cruz versus a redirection toward Watsonville for reclamation are less easily remedied. Concern over a new ocean discharge can be mitigated to some degree by careful site studies and environmental assessments at the facility planning level. It is clearly beneficial to eliminate short outfalls in the north Monterey Bay area; it is beneficial to upgrade treatment at least to the physical-chemical level available at Santa Cruz. It is believed that the most assured water quality control program consistent with state policy and federal cost-effectiveness guidelines is to utilize the outfall concept in the recommended plan. This is the most economically efficient plan. Reclamation markets near Watsonville are not established, and disposal would require increased discharge to Monterey Bay to relatively shallow waters off Watsonville unless full use of reclaimed water were accomplished.

Maintenance of long-term productivity relative to water quality is encouraged by elimination of the short outfalls to northern Monterey Bay and provision of an outfall facility off Point Santa Cruz. However, questions arise concerning long-term reclamation potential of this aspect of the plan. Water quality control aspects lead to selection of the Point Santa Cruz outfall mode since an eastward consolidation requiring a larger Bay outfall does not give the same assurance of water quality control, as Bay currents trend northward toward the environmentally sensitive "north pocket." Relative to facility staging, short-term impacts may result from construction of interceptors and outfall facilities prior to upgrading of treatment at Santa Cruz unless financial resources permit concurrent programs. Long-term productivity in the San Lorenzo Valley area is better served by feasibility studies in view of the paucity of data to support abandonment of septic tank systems which, from present evidence, appear workable in that area.

Resource commitments which may be irretrievably lost or irreversible are largely those involved in the construction of interceptors, pumping stations, outfall facilities and in upgraded treatment plus the energy and chemicals required for their operation.

Growth inducement associated with these plans is minor. The probability that much of the San Lorenzo Valley would remain on septic systems will depend in part on population density; increased growth would increase sewerage feasibility both in terms of environmental needs and financial repayment ability. The Santa Cruz coastal area and Scott Valley interceptor route would be growth accommodating by the fact that sewer service would not be a limiting factor. Growth is already concentrated along the coastal zone because of local topography, although the pipeline route would also favor strip development.

Aptos-Soquel Creeks Sub-Basin

Environmental impact aspects of this sub-basin are covered in considerations of the coastal region of the San Lorenzo River sub-basin. The major question of the direction of consolidation westward to the ocean for disposal or eastward to the Pajaro River sub-basin for reclamation has been discussed. Benefits of consolidation include elimination of short outfalls in the sub-basin—one from Eastcliff (4 mgd), and a second at Aptos (0.8 mgd)—and the abandonment of a small treatment facility at Sand Dollar Beach (.03 mgd). Sewerage service would benefit unsewered La Selva Beach; however, growth accommodation impacts would pertain here as described for previous sub-basins.

Pajaro River Sub-Basin

Environmental impacts of recommended plans for the Pajro River Sub-basin differ in character between the coastal area near Watsonville and the inland regions near Gilroy and Hollister. Long term impacts relate to surface water quality control in the Watsonville Region and to groundwater degradation questions inland. Environmental impacts associated with recommended plans for the Pajaro River Sub-basin are:

1. Interceptor sewer construction associated with each region of the sub-basin would have short term construction impacts and accomodate growth along the pipeline routes.

2. Upgraded treatment at the Watsonville treatment plant (13.5 mgd) to produce a secondary level effluent and extensions to the outfall into Central Monterey Bay will improve surface water quality and increase reliability of disinfection to protect local shellfish harvesting.

3. Extension of the existing ocean outfall to deeper water in order to comply with dilution requirements of the State Ocean Policy will result in short-term construction impacts; long-term adverse impacts on local marine life are not anticipated in view of conclusions of the Department of Fish and Game which has observed normal biota for this sandy beach area; however possible effects of the outfall on microfauna have been noted as requiring future study.

4. Continued discharge to Central Monterey Bay will add greater amounts of nutrient materials as a result of consolidation of wastewater flows at the Watsonville Regional Treatment plant.

5. Possible future reclamation programs involving Watsonville region wastewaters and coastal areas to the north and west are not precluded by the recommended plan; retention and extension of the Watsonville ocean outfall facility provides an environmentally acceptable disposal mode for wet weather flows sould seasonal wastewater reclamation programs such as crop irrigation become feasible.

6. Elimination of a surface water discharge from San Juan Bautista (0.2 mgd) during dry periods in favor of a land disposal project is beneficial to San Benito River water quality. Local irrigation reuse would be preferrable to percolation disposal in this area in order to avoid taking prime agricultural land for elluent disposal.

7. Options to retain separate land disposal facilities at the Hollister industrial site and San Juan Bautista may prove more environmentally acceptable if effluent demineralization or salt source control programs are not feasible. Separation of percolation basins or irrigation programs would reduce localized effects of a larger disposal operation during periods when effluent salinity exceeds that found in underlying groundwaters.

8. Fexibility of increased treatment to provide partial demineralization to reduce salt emissions to local groundwaters is a beneficial aspect of the plan; emphasis will be placed on salt source controls in early years; should source control prove ineffective and groundwater degradation be threatened, consolidation and effluent demineralization should be implemented.

9. Increased wastewater flow and upgraded treatment will increase sludge volumes at each treatment site.

10. Air quality, noise emissions, energy use and traffic associated with the recommended plans are negligible with the possible exception of a future possibility for demineralization.

Mitigating factors of the recommended plans for this sub-basin are suggested in the listing of environmental impacts. For example, concerns over surface water quality and marine life in Monterey Bay expressed in Item 3 above should be mitigated by improved treatment and dilution effected by the Watsonville outfall extension. Further control is provided by source control of cumulative toxicants pursuant to section 307 of the new Federal Water Pollution Control Act; see Chapter 4. Nutrient enrichment effects have been quantified in the ecological model for Monterey Bay described in studies by AMBAG; model results have shown negligible effects of algal growth resulting from projected nutrient emissions from the Watsonville outfall. It should be emphasized that effects of the present discharge following primary treatment through a shorter outfall have produced no demonstrable effects on local marine life with the exception of possible coliform bacteria contamination of local shellfish. This latter impact is correctable by the improved reliability of disinfection provided for in the recommended plan. Chlorine residuals will be controlled by dechlorination to prevent toxic effects.

Increased sludge production as a result of upgraded treatment will not result in environmental problems where organic materials are digested and returned to land as fill material or for local farming use. The various dischargers have different programs for sludge processing varying from lagooning to drying bed operations with ultimate disposal to land. A more serious sludge related problem will result in the Hollister area if effluent demineralization is implemented, as brines captured from the effluent will require disposal to impervious ponds or export to salt water.

Land disposal of wastewater effluents by percolation will require careful studies of disposal sites including underlying groundwaters to insure against groundwater degradation. Where fault zones separate groundwaters of different quality such as is alleged near Hollister, the disposal site location should be in the area overlying poorer groundwaters. Groundwaters in the Gilroy area are separated by aquicludes. Shallow upper groundwaters of poor quality may be affected by percolation; however, deeper pressurized zones are not so likely to be influenced by wastewater percolation. Source control measures including water supply changes, municipal well softening and control of unusual salt sources in the sewer system by local ordinance to reduce mineral increments may correct excessive effluent salinity and thus protect groundwaters. Where source measures are not effective and where groundwaters are threatened with degradation as a result of effluent disposal, a small portion of the wastewater could be demineralized and blended prior to percolation to groundwater.

Maintenance of long-term productivity is provided for in the recommended plan through the flexibility provided for reclamation in the Watsonville region and the options available to prevent groundwater degradation in the Gilroy-Hollister region. Surface water quality and associated aquatic life, particularly in Monterey Bay, are protected by this plan. Past shellfish contamination attributed to effluent discharge near Watsonville should be eliminated by more reliable disinfection provided by plan implementation. Sludge reclamation for use on agricultural lands is maintained as an option. Short-term adverse impacts are principally related to construction effects with the exception of groundwater quality questions near Gilroy and Hollister, discussed above.

Irreversible and irretrievable committments of resources are associated with construction materials and energy and chemicals required for operation of wastewater facilities. Resources protected include Monterey Bay marine life and shellfish beds which require protection from long term effects of cumulative toxicants; similarly groundwaters require protection from long term salinity increases or other factors causing degradation; plan provisions provide flexibility to provide relevant groundwater protection depending on success or failure of salt source control measures.

Growth inducement effects of the recommended municipal facility plans for the Pajaro River Sub-basin are minor in terms of major changes in the character of this area. Some growth inducement may be associated with sewerage facility extensions to Aromas and Los Lomos-Hall in that new sewers could encourage more dense development along the interceptor route unless local planning maintains open space and agricultural lands so as to prevent intensive strip development. Population growth may be more dense in the Morgan Hill-Gilroy area as a result of the provision of adequate sewerage facilities in that these utilities will accomodate population increases associated with urban sprawl from San Jose.

Salinas River Sub-Basin

The Salinas River Sub-basin covers an extensive area from the urbanized southwestern coastal strip of Monterey Bay inland to agricultural areas of the Salinas Valley and resorts and reservoirs in the headwaters. Because municipal facility plans differ greatly between the coastal and the inland region, separate discussions of environmental impacts have been provided.

Coastal Region

Environmental impacts of the recommended plan for municipal sewerage facilities in the coastal region of the Salinas River Sub-basin are probably more extensive than in any other area of the Central Coastal Basin. Consolidation of facilities is a major aspect of this plan; consequently more changes in treatment facility and disposal arrangements are called for. These have major environmental implications. Environmental impacts associated with this region are:

1. Interceptor sewer and pumping station construction along the coastal area of southern Monterey Bay would have short term construction impacts and accommodate growth along the pipeline route.

2. Early abandonment of the Pacific Grove treatment plant (2 mgd) with diversion of wastewater volumes to an expanded upgraded Monterey treatment and outfall facility will increase localized effluent volume loadings to the sensitive "south pocket" area of Monterey Bay by about 50 percent. However upgraded treatment at Monterey will reduce emission of pollutants.

3. Subsequent abandonment of remaining outfall facilities (Monterey, Seaside, Fort Ord and Marina) discharging approximately 10 mgd to the "south pocket" of Monterey Bay, will improve water quality by transferring effluent disposal to a point of lower environmental sensitivity and where greater dispersion can be achieved through utilization of a Central Monterey Bay outfall and diffuser system capable of meeting requirements of the State Ocean Policy.

4. Elimination of direct discharges of approximately 6 mgd to Salinas River waters from treatment facilities operated by the City of Salinas will improve surface water quality in the vicinity of these discharges. Benefits in downstream river areas below Spreckles may be questionable inasmuch as river flow may be reduced substantially during the dry season leaving little water in this reach except agricultural drainage.

5. Elimination of direct discharge of approximately 0.4 mgd to Tembladero Slough from the Castroville treatment facility will benefit surface water quality; however ealry consolidation of Castroville with the urban area to the south may not be implemented until other nearby communities are sewered and join with Castroville. An interim project directing effluent to land would be beneficial to surface water quality and could serve as an irrigation reuse demonstration program for this area.

6. Studies of outfall sites, including local currents, bottom conditions and marine life associations as preliminary steps in planning for an outfall into Central Monterey Bay is a desirable and necessary aspect of the plan staging. Evnironmental aspects will require careful assessment to insure that consolidation of effluent disposal at this point does not lead to degradation of local water quality or adversely disrupt marine ecosystems. The question of benefit of a total consolidation of about 30 mgd to a Central Bay site versus continued use or upgrading of the smaller existing outfalls and Salinas River discharge must be addressed; similarly treatment upgrading and reclamation potential gained by the consolidation must be considered in the environmental assessment. Nutrient effects of such discharge have already been assessed in an ecological model developed for the AMBAG plan.

7. Interceptor sewer construction from Salinas and Fort Ord East will cause short term construction impacts including disruptions of riparian habitats along the Salinas River; growth inducement questions will arise where pipeline routes

cross land suitable for agriculture which may be more easily urbanized by the presence of sewerage facilities. Similar questions will arise due to future consolidation from Moss Landing and Castroville southward to the outfall facility or, if deferred, to the regional treatment plant which can serve the entire service area.

8. Provision of sewerage services in the Moss Landing and Prundale areas will be growth accommodating; however, the likelihood of intensive urbanization in these areas is less probable than the southern shore area.

9. Construction of a regional secondary treatment plant in the lower Salinas River area west of Salinas will cause short term construction impacts and change land use on the site with probable displacement of agriculture or wildlife habitat depending on site selection. A long range commitment to regional treatment will have a major benefit to communities served since local treatment plants in more urbanized areas can be abandoned or converted to local reclamation use. The predominately agricultural locale for the regional plant maximizes reclamation opportunities for crop irrigation and buffers the treatment plant from urbanized areas where such facilities are generally unwelcome neighbors.

10. Provision of reclamation facilities including nutrient removal processes at the regional treatment plant can provide water quality enhancement benefits to the lower Salinas River area if effluent release is desired for water quality control in the eutrophic waters downstream of Spreckles.

11. The staged consolidation program provides for water quality control in a progressive fashion involving interim improvements to existing facilities and elimination of inadequate or poorly sited outfalls. The plan also provides for maximum reclamation potential through direction of effluents of good mineral quality from the Monterey Peninsula which can be used more effectively in irrigation of truck crops than more mineralized wastewaters from the Salinas area. The blending of wastewaters from these two areas makes irrigation use feasible; direct reuse of the more mineralized Salinas effluents for crop irrigation would be questionable for local crops.

12. A program involving irrigation reuse on local agricultural lands in the lower Salinas River area west of Salinas and near Castroville has beneficial impacts conditioned by public health and alternative water resource aspects. Where irrigation of vegetable crops is envisioned, the health risks must be eliminated to the satisfaction of all concerned agencies, farmers and the general public; this will require additional work in the form of on-farm demonstrations and careful analysis of crops produced. Water resource aspects must be faced in terms of the need for reclaimed water in this area as compared with other acceptable water sources including upstream impoundments for conjunctive management of groundwaters. Long term salt buildup impacts of irrigation reuse in this area on upper aquifer groundwaters are considered minor when effluents are comparable in mineral quality to local irrigation supplies and where irrigation areas are so near the coast. Public water supplies in the Castroville-Salinas area are pumped from deep pressure aquifers which would not be directly affected by percolation in this region.

13. Sludge produced from a consolidated treatment facility in an agricultural area will be less difficult to manage than separate operations in urbanized areas. Local sludge disposal involves different practices ranging from incineration to lagooning. Use of sludges can be encouraged at the regional facility; however public health precautions will be necessary, particularly where truck crops are involved.

14. Air quality, noise emissions, energy use and traffic associated with the recommended plan elements are largely related to construction impacts. Energy aspects of treatment also pertain to maintenance of the status quo assuming secondary level treatment is a common goal; pumping will involve energy commitments which are minor in this area. Air quality, namely odors, will be improved by the greater ability to buffer the regional plant from urban areas.

Mitigating factors, beyond those incorporated with many of the itemized impacts are tied to the longer range gains offered by effective consolidation directed toward a major reclamation possibility. Water quality control is emphasized in the facility staging, yet local options for reclamation may be accommodated either by use of abandoned facilities or local construction of small reclamation projects. A local reclamation project could also withdraw and treat needed wastewater volumes and discharge residual sludges back into the interceptor. Local uses such as golf course or park irrigation would be logical, particularly in areas having a limited water supply.

Maintenance of long term productivity is clearly established by the commitment of the recommended plan to water quality control as a first priority item with major reclamation features as a future program.

Resources commitments are irreversible in the sense that major facilities would be built and others abandoned, and these activities consume materials, energy and a considerable financial resource. Yet the plan is a positive step from all that is known of Monterey Bay sensitivity to waste discharge and the reclamation options provided.

Growth inducement could be a problem, particularly along the routes of interceptor sewers since development may be encouraged along these corridors. This is more of a problem where prime agricultural land or scenic coastal areas are converted to intensive urbanization. Development of the service areas tributary to the regional plant will be accommodated by the adequacy of these facilities and may be thwarted in some places by inadequacy of present facilities. This dilemma confronts planners everywhere; meanwhile resolution of the use of utility service constraints versus a more thoughtful use of environmental constraints in effecting land use patterns is a subject for debate. If local planning fails, the environmental impact assessment process can be an important part of the solution to this problem.

Inland Region

Environmental impacts associated with recommended plans for the inland areas of the Salinas River Sub-basin are relatively minor in that no major changes in present practices are involved. Generally, the existing facilities and land disposal operations conducted by the scattered communities along the Salinas River are acceptable in concept, although new facilities are being built for Paso Robles and are recommended in the San Antonio Reservoir and Nacimiento Reservoir areas. Environmental impacts for this area include:

1) Continued reliance on land disposal in the Salinas River Valley raises questions of localized groundwater degradation near the disposal areas; as each operation is small (less than 1 mgd) this impact is not major. Many of these communities divert effluent to spray irrigation of crops in the dry season.

2) Interceptor sewer construction recommended for the consolidation of Templeton with Paso Robles and lesser consolidations at King City and Atascadero would have short-term construction impacts and some localized growth pattern influence along the pipeline routes.

3) Continued use of oxidation pond systems in the Salinas Valley could be beneficial to overall environmental control in that these low cost systems function well in this locale and could permit financial resources to be diverted to other environmental quality control measures such as flood protection of treatment plants or disposal sites and salt source control measures.

4) The small facilities (less than 0.5 mgd) near San Antonio and Nacimiento reservoirs will benefit water quality by providing needed sewerage services which, if not provided, could lead to eutrophication of these impounded waters. Spray disposal in summer will maximize vegetative uptake of nutrients providing greater long-term protection than year-round percolation in these watersheds.

5) Sewerage feasibility studies at Shandon will permit orderly planning for improvements if septic tank systems are determined to be unworkable under a septic tank management district.

6) Sludge production, treatment, and disposal problems are minor if not non-existent in this area since most facilities involve oxidation ponds. Those facilities that do generate sludge are located in rural areas which offer ample land for disposal in the liquid or dewatered form.

7) Air quality, noise emission, energy use and traffic impacts associated with these recommendations are negligible.

Mitigation measures have been identified with these minor impacts; recommended plans for this area which are little more than continuation of the present practices, represent no major effects on long-term productivity or resource committments. Minor aspects pertain to localized groundwater conditions if salt source control measures are not successful, yet even this aspect is minor in view of the general reliance on irrigation techniques in the dry season. Discharges are small in volume and the agricultural character of most of this region suggests little in the way of exotic wastes in the sewer systems except those from hospitals or local metal plating shops. The largest dischargers are Paso Robles (1.0 mgd), King City (0.5 mgd) and Soledad Prison (0.5 mgd); the remaining discharges are less than 0.5 mgd and are scattered along the length of the Salinas Valley. Growth inducement is negligible due to these plans; however, localized strip development patterns could result along major sewer routes in King City and Paso Robles.

Carmel River Sub-Basin

Environmental impacts associated with the Carmel River Sub-basin are significant in a local context and involve questions of reclamation versus cost-effective water quality control. Environmental impacts of the recommended plan include:

1) Interceptor sewer and pumping facilities constructed between Carmel Highlands and Carmel will have short-term construction impacts and will accommodate growth along the pipeline route.

2) Abandonment of the Carmel Highlands septic tank facilities which discharge to ocean waters from a cliff area is beneficial and clearly in the interest of environmental quality control.

3) Sewerage feasibility studies recommended for Carmel Valley will encourage orderly facility planning yet leave an option open for septic tank management for areas which can demonstrate that such individual systems are workable. Growth impacts in Carmel Valley will be more apparent if sewering is implemented. Groundwater degradation questions will arise in the mid and lower Carmel Valley area if sewerage facilities direct effluents to land; studies of this area should include disposal site feasibility.

4) Retention of the existing outfall which discharges to the outer portion of Carmel Bay represents a problematical adverse impact in that studies of this area have not documented any ill effects. Classification of Carmel Bay as ocean waters places this discharge under the jurisdiction of the State ocean policy, which together with this basin plan, require strict limits for toxicants, including those which accumulate in marine life, as well as providing dilution criteria. The unique marine resources of Point Lobos State Park alone require the continued monitoring of effects from this discharge.

5) Should effluent irrigation or other seasonal reclamation possibilities be implemented, use of the existing outfall provides a reliable water quality control facility for use during winter or wet weather periods. Abandonment of the outfall can be accomplished should alternative disposal practices prove workable on a year-round basis. Meanwhile, disposal facilities are available for effective water quality control, at least until proven otherwise by scientific study.

6) Sludge production and treatment and disposal problems will increase at the Carmel Sanitation District facility; however, land disposal operations will not be adversely affected by a small volume increase.

7) Air quality , noise emissions, energy use and traffic impacts associated with the recommended plan for this area are minor.

Mitigating measures are largely those associated with outfall effects versus the reclamation dilemma in wet seasons. Short-term impacts of construction are of less concern; however, mitigation of these effects may be quite serious locally in view of the high value of real estate in this area.

Long-term productivity is not compromised by retention of the outfall insofar as there is no documentation that a problem exists in Carmel Bay due to this practice. Similarly the irretrievable or irreversible aspects of this project are not at issue except in the structures and energy involved for conveyance, treatment and disposal. Growth inducement could be a local problem in that the facilities described would be growth accommodating.

Monterey Coastal Sub-Basin

Environmental impacts due to facilities recommended in this sub-basin are negligible; facility improvements are beneficial at Pfeiffer-Big Sur State Park and no action is required at the Point Sur Naval Facility. This sparsely settled sub-basin is affected more by tourism and non-point impacts than those for facilities identified above.

San Luis Obispo Coastal Sub-Basin

This sub-basin includes a variety of facility plans which are best discussed separately. Accordingly three regions will be described; the San Simeon-Morro Bay Region, the San Luis Obispo Region and the South San Luis Obispo County Region.

San Simeon-Morro Bay Region

Environmental impacts for the recommended plans for communities in this region pertain principally to land disposal considerations and trade-offs identified between maintenance of a local water balance versus a lower energy solution involving ocean disposal through several outfalls in a pristine coastal area. Communities in this region include the Hearst Castle and State Beach, San Simeon Acres, Cambria, Cayucos, Morro Bay, Baywood Park, Los Osos and the California Men's Colony. Environmental impacts include:

1) Emphasis on percolation of effluents at local sites near the communities of San Simeon Acres, Cambria, the Cambria Air Force Radar Station Dependent Housing, Morro Bay and the California Men's Colony has a beneficial impact on local water balance; each of these discharges is small in comparison to the groundwater basin; however, Health Department considerations will require that disposal operations be conducted remote from the influence of local municipal wells. The largest of these operations, California Men's Colony (1.3 mgd) and Morro Bay (1.1 mgd), would provide for seasonal irrigation reuse by substituting effluent for groundwater pumping. The smaller dischargers such as Cambria (0.2 mgd) and San Simeon Acrea (0.1 mgd) could conduct similar operations. Substitution of effluent for groundwater pumping would minimize health concerns; however, percolation operations would be required in winter.

2) Sewerage feasibility studies recommended for the Los Osos-Baywood area will define the need and priority for sewering this community. Septic tank management approaches will be stressed for areas remaining on these systems. Effluent disposal for areas sewered can be accomplished so as to maintain water balance and prevent degradation of local high quality groundwaters through percolation into nearby areas where groundwaters are more highly mineralized; such areas have been identified by the Department of Water Resources Irrigation approaches can be also used to substitute effluents for groundwater pumping.

3) Sewering of all or a portion of the Los Osos-Baywood area and expansion of the sewerage collection system in Cambria will have growth accommodating influences since lot size constraints involving septic tank systems would no longer apply.

4) Elimination of direct discharge to Chorro Creek from the California Men's Colony (1.3 mgd) will reduce stream flow during the dry season, but will reduce nutrient loadings tributary to Morro Bay and eliminate public health concerns relative to a direct discharge of sewage origin upstream from a municipal well field.

5) Local irrigation reuse of California Men's Colony wastewater effluent by the California Polytechnic State University is a beneficial use of these waters.

6) Protection of sensitive habitats in Morro Bay including shellfish, by elimination of direct discharges of sewage origin to these waters and their tributaries is beneficial.

7) Maintenance of separate wastewater facilities in this region eliminates the concern over strip development along interceptor pipeline routes. Also consolidation and the retention of small local land disposal operations in local groundwater basins in preference to a larger regional land disposal operation, which has negative resource conservation and public health aspects, would improve local water balance situations.

8)Sludge disposal problems associated with these small facilities are negligible in view of the availability of land for dewatering and safe disposal.

9) Air quality, noise emissions, energy use and traffic impacts associated with the recommended plans are negligible although an energy use increase is apparent as explained in item 1.

Mitigating factors and trade-offs have been identified with the itemized impacts. Groundwater quality and quantity factors are of major concern in this area, the plans protect water balance and provide for quality mitigation in treatment options such as nitrate removal, disposal site selection, salt source controls where necessary, and substitution techniques on a seasonal basis to exchange groundwater pumping for direct effluent irrigation of crops.

Long-term productivity is addressed in these plans as described in above remarks relative to water balance and protection of surface and groundwaters. Irretrievable or irreversible resource commitments have positive connotations in this area in view of the total water management approach offered. Energy aspects of the plan are minor when compared with ocean outfall to a pristine coastal area after one cycle of water use.

Growth accommodation is provided for in the plans by the adequacy of sewerage services and positive impact on water balance; negative aspects of this subject may be more evident in the Los Osos-Baywood area.

San Luis Obispo Region

Environmental impacts for the San Luis Obispo Region are confined to those associated with the City of San Luis Obispo wastewater facilities and implications of discharge to surface waters or reclamation in this area. Environmental impacts include:

1) Continued reliance on discharge to San Luis Obispo Creek (4.0 mgd) will require a major reevaluation of effects on downstream areas including water quality factors affecting eutrophication in a small impoundment south of the city. The direct discharge of nutrients from the city treatment plant will require an effluent quality equivalent to water quality objectives for this stream unless it is demonstrated that such control is not cost-effective. Non-point source control aspects of this evaluation will require assessment of livestock and other contributions of nutrients to this stream segment.

2) Prohibition of direct discharge to San Luis Obispo Creek is required during low flow periods if non degradation cannot be assured; this requirement of the recommended plan presents a dilemma involving adverse effects of stream flow reductions which will in essence dry up this reach during summer and forces irrigation disposal on soils having low infiltration rates.

3) Non degradation questions pertaining to salinity of the discharge relative to the mineral quality of San Luis Obispo Creek require salt source controls to reduce excessive mineral increments (>500 mg/l as TDS) in this wastewater. The mineral degradation question should be explored through a salt source inventory to place non-point emissions in perspective with the city discharge. Benefits associated with this aspect of the plan pertain to compliance with the non degradation policy; however, beneficial uses affected should be a determining factor in justifying even partial effluent demineralization so long as salt source control is effected to reduce TDS increments to a more reasonable level (e.g., or 300 mg/l).

4) Reclamation opportunities provided for by upgraded treatment have beneficial impacts in terms of local effluent reuse for golf course irrigation and water level maintenance and flushing of Laguna Lake.

5) Improved management of wet weather flows and infiltration/inflow corrections will benefit winter operations of this facility.

6) Sludge disposal problems may be greatly magnified if nutrient removal is implemented at the plant since chemicals used for phosphorus removal will also require disposal with organic residues. Disposal to land would be acceptable; however, if lime is used reclamation of lime for reuse in the plant will require incineration.

7) Chemical usage will be increased for nutrient removal including some organic carbon source (such as methanol) for nitrogen removal and chemicals (such as alum, lime or ferric chloride) for phosphorus removal. Chlorine usage would not increase markedly if treatment is upgraded.

8) Air quality, noise emissions, energy use and traffic impacts would be expected to increase somewhat with upgrading of treatment to provide for nutrient removal or partial demineralization. For example, incineration would be required for lime recovery and more process equipment and chemicals would be needed which increase operational activities including increased direct and indirect energy use and deliveries of materials to the plant.

Mitigating factors have been identified with the above listed impacts; the trade-offs of stream discharge and land disposal have been described in the context of environmental constraints which affect each disposal method. If nutrient or salt removal is to be implemented to maintain streamflow for downstream uses, including agriculture, then the benefits of this upgraded effluent should not be lost by downstream activities within the riparian habitat, such as cattle freely wandering and taking other liberties in the streambed. Similarly, soil constraints do not suggest that land disposal is viable in this area and elimination of discharge will remove essentially all streamflow in summer. Careful appraisal of these factors and the extent of non-point controls and reclamation needs will determine timing and future priorities for implementation of upgraded treatment at San Luis Obispo.

Long-term productivity is provided by the staging suggested in the recommended plan as described above. This area requires careful thought to insure resources directed totally at pollution control are not wasted efforts or environmentally unsound.

Irreversible or irretrievable components of the recommended plan pertain principally to commitments which will be made, depending on which disposal mode is finally implemented. Should stream discharge be maintained and reclamation projects be developed, then nutrient removal will probably be needed, but not until non-point controls are also found feasible. This pathway commits resources such as chemicals and energy. Should land disposal be selected, the commitment is to pipelines and a large land area (200 acres) with resultant stream flow reduction.

Growth implications of the plan or the options discussed are not serious in this area since the main factor is adequacy of the sewerage service; this is growth accommodating to an extent, but is more influential locally where major changes such as new interceptor routes or sewering of presently unsewered areas are involved.

South San Luis Obispo County Region

Environmental impacts of this region are limited to those associated with ocean disposal at Avila Beach, Pismo Beach and South San Luis Obispo County Sanitation District and to sewerage operations at the Lopez Recreation area.

1) Disposal of secondary effluent to ocean waters off sandy beach areas through ocean outfall systems consistent with the State ocean policy will provide beneficial impacts related to water quality control. In each case the discharge volume is small; the total capacity of present facilities is less than 4.0 mgd. Disinfection practices will protect quality of local shellfish resources. The possible discharge of Pismo Beach and South San Luis Obispo CSD through a joint outfall is viewed as environmentally equivalent to maintenance of separate facilities; since present outfalls are either inadequate for long-term use (Pismo Beach) or damaged (South San Luis Obispo CSD), a possible joint disposal mode is not precluded by present arrangements.

2) Upgraded treatment from primary to secondary at the small (0.2 mgd) Avila Beach plant may enhance local ocean water quality; but except for floatable removal, this change is probably negligible compared with outfall improvements to meet dilution requirements of the State ocean plan. Kelp beds to the south and west of the discharge are not expected to be affected by so small a discharge.

3) Growth inducement aspects of separate or combined facilities are comparable and can be termed growth accommodating once the recommended plan or joint disposal option is implemented.

4) Sludge problems are not associated with the recommendations for these facilities since secondary treatment is available at Pismo Beach and South San Luis Obispo CSD; Avila Beach treatment upgrading will increase solids production by about 50 percent, but volumes are small.

5) Reclamation reuse is not a major feature of the plans in this coastal area, however, secondary effluents are available for local reuse such as park or golf course irrigation should such projects be locally supported.

6) Lopez Recreational Area sewerage facilities will provide secondary treatment, and land disposal practices will continue to protect surface water quality in this area. Nitrate impairment of groundwater quality from this small (0.1 mgd) seasonal discharge is viewed as of low probability but local groundwaters will be monitored to determine if measurable effects occur.

7) Air quality, noise emission, energy use and traffic impacts associated with the recommended plan for this region are minor.

Mitigating factors are not of major concern for these plans since beneficial aspects are predominant and questions of effects on ocean resources off sandy beaches are covered by treatment and disinfection relative to local shellfish resources and sandy bottom habitats are not considered sensitive from evidence available. Reclamation aspects are not precluded by these plans.

Long-term productivity and resource commitments are not identified as incompatible with these plans inasmuch as water quality control measures are not complicated by competing factors. Similarly, growth inducement is characterized by growth accommodation as discussed earlier.

Soda Lake Sub-Basin

There are no sewerage facilities considered for this sub-basin.

Santa Maria River Sub-Basin

Environmental impacts associated with the Santa Maria River Sub-basin are largely those pertaining to effects on groundwaters of the Santa Maria Valley. Municipal dischargers in this area include the City of Santa Maria, Guadalupe, the Laguna County Sanitation District and the Santa Maria Public Airport. Other areas considered in this sub-basin are the unsewered Nipoma area and Cuyama Valley Community Services, the latter located in the upper portion of the watershed. Environmental impacts include:

1) Consolidation of the Santa Maria Public Airport sewerage facilities with either the City of Santa Maria (6.5 mgd) or Laguna County Sanitation District (1.3 mgd) is beneficial in that a small treatment facility (0.7 mgd) in poor condition will be abandoned. Growth inducement questions and social impacts of consolidation with the City of Santa Maria and Laguna County S.D. differ to a degree in that annexation by the City could be an issue. Growth inducement can be termed growth accommodating along the pipeline route.

2) Sewerage feasibility studies at Nipomo will permit orderly planning for improvements if septic tank systems are determined to be unworkable under a septic tank management district.

3) Control of effluent mineral quality through either municipal well water softening or demineralization of a portion of the effluent flow will be a positive corrective measure toward making effluent disposal from point sources compatible with the local groundwater quality situation. Past practices, including water softener brine disposal, have produced mineral increments from 500-730 mg/l in excess of water supply quality in Santa Maria Valley discharges. Water supplies are highly mineralized (1,000 mg/l) reflecting natural conditions in the watershed, municipal waste disposal and deep percolation of agricultural drainage waters; groundwaters of this area are under study relative to salt balance and salt control measures due to non point sources.

4) Implementation of lime soda softening of municipal well waters would upgrade the public water supply providing direct benefits to residents and industry and eliminating the need for home water softeners in this area. Elimination of home water softeners will reduce brine disposal to sewer systems and therefore reduce mineral increments in the wastewater. Municipal wastewaters of lower salt content could then be used more efficiently for crop irrigation and would have less negative effect on local groundwater quality. Their recharge will help maintain water balance.

5) Upgrading of treatment, whether water supply or waste effluents, to reduce salt emissions, though beneficial, will not eliminate salt accumulation problems in this groundwater basin. The total management of the Santa Maria Valley groundwater basin will involve agricultural activities as well as conjunctive groundwater management, possibly including development or importation of surface supplies.

6) Brine disposal from effluent demineralization or sludges from lime soda softening of the municipal water supplies will require land for containment or ocean disposal. Organic sludges at the treatment plants are relatively easily returned to land in this sub-basin.

7) Energy use will increase markedly if demineralization is practiced; chemical use will increase with the municipal well softening approach. Traffic, noise and air quality impacts due to the plan are considered negligible in this sub-basin.

8) Improved effluent disposal in Cuyama Valley (.03 mgd) through land disposal will eliminate a surface discharge and thus provide some local benefit to water quality, although such a change cannot be viewed as urgently needed.

Mitigating factors relative to remaining problems affecting groundwater mineral quality pertain to corrective measures for non point source control. Agricultural waste loads in the Santa Maria Valley have been computed to be 200,000 tons per year due to irrigation drainage, much of which will be carried into the alluvium underlying this large valley. Agricultural activities such as irrigation concentrate salts by a factor from two to five times in the evapotranspiration process, thus percolating drainage from crop lands will exceed underlying groundwater quality by a comparable amount in an alluvium such as exists in the Santa Maria Valley. Municipal effluents percolated to these same groundwaters are less concentrated than agricultural drainage. Following recommended plan improvements, these municipal effluents will be of lower salinity than at present by about 200-400 mg/l.

Long-term productivity is associated with long range groundwater enhancement needed in this sub-basin. Controls recommended for municipal facilities are a beneficial and positive step forward both for water quality control and water supply management. Similarly resource commitments are positively directed away from past degradation toward a future enhancement possibility if non point salt source controls can be managed effectively.

Growth related aspects pertain more to the improvement of the quality of local water supplies which may be a factor in promoting growth in the Santa Maria Valley. Such growth, though expected to be modest, should be controlled so as to protect more fertile agricultural lands from urbanization.

San Antonio Creek Sub-Basin

There are no sewerage facilities in this sub-basin which involve waste discharge operations; however, salt water regenerated from Vandenberg Air Force ion-exchange softening plant is disposed to land in the lower portion of this basin. Impact of this practice is negligible in view of the salinity of underlying groundwaters.

Santa Ynez River Sub-Basin

Recommended plans for the Santa Ynez River Sub-basin concern ocean disposal from Vandenberg Air Force Base, consolidation of facilities for stream disposal near Lompoc, and separate land disposal programs at Buellton and Solvang. Environmental impacts associated with these plans include:

1. Ocean discharge from Vandenberg Air Force Base (3.0 mgd) will require reconstruction of a new ocean outfall; provision of secondary treatment and disinfection with an adequate outfall will have negligible long-term adverse impact so long as toxicant source control is practiced.

2. Interceptor sewer and expanded pumping station facilities constructed to convey wastewaters from the Federal Correctional Institute to Lompoc, including excavation of pipeline in crossing the Santa Ynez River bed, will have short term construction impacts including turbidity in downstream surface waters.

3. Abandonment of the small Federal Correctional Institute wastewater treatment facility (0.3 mgd) will eliminate a direct stream discharge to surface waters which cannot meet secondary treatment requirements. The facility recommended for abandonment is old and would require extensive rehabilitation to provide reliable secondary treatment consistent with EPA guidelines.

4. Upgrading of the City of Lompoc treatment facility to provide secondary treatment, including nitrification and disinfection prior to discharge to the Santa Ynez River, will provide needed treatment to protect downstream beneficial uses consistent with EPA secondary treatment requirements and State Department of Health guidelines for reclaimed water.

5. Direct discharge to the lower reaches of the Santa Ynez River will also recharge local groundwater during much of the year; prior to percolation the river bed, the discharge will augment stream flow by about 5 mgd in this otherwise seasonally dry channel.

6. Eutrophication problems in downstream reaches of the Santa Ynez may occur as a result of stream discharge without nutrient removal. This impact is mitigated by percolation during the dry season when eutrophication is more likely to occur and by dilution and flushing of the estuary during runoff periods which provide sufficient river flow to cause effluent to reach tidal waters.

7. Groundwater degradation may occur as a result of the percolation of effluent from the Lompoc Regional plant since local effluents are known to be high in total dissolved solids reflecting the character of local groundwater supplies and an excessive mineral increment (500-800 mg/l). However, groundwater which occurs in the lower Santa Ynez River area is of poor mineral quality; for example, the Lompoc subunit averages over 1,500 mg/l TDS and nearly 750 mg/l total hardness as compared with 600 mg/l TDS and 400 mg/l hardness in the Santa Ynez sub-basin upstream. Nitrate concentrations in these two groundwater basins are comparable, averaging about 8 mg/l in each basin.

8. Control of wastewater mineral quality by lime soda softening or water supply source changes and a strict salt source control program to prevent water softener brines from entering the sewer system will eliminate groundwater degradation

questions relative to the Lompoc subunits downstream of the discharge. A tangible benefit to local water users can be identified if local water supply improvements are accomplished.

9. Percolation of wastewater following secondary treatment may lead to degradation in the Buellton groundwater basin; however, the discharges are small (0.3 mgd each) and seasonal irrigation is practiced at the upper discharge (Solvang) which minimizes nitrate buildup concerns; a similar program is recommended for Buellton. Mineral increment limits (less than 300 mg/l TDS) have been established which have encouraged salt source control programs at both Buellton and Solvang where past mineral increments have ranged from 500-700 mg/l TDS. Removal of salts from the basin by wintertime flows of the Santa Ynez River also contribute to maintenance of good groundwater quality.

10. Percolation of wastewater following secondary treatment may lead to degradation in the Buellton groundwater basin; however, the discharges are small (0.3 mgd each) and seasonal irrigation is practiced at the upper discharge (Solvang) which minimizes nitrate buildup concerns; a similar program is recommended for Buellton. Mineral increment limits (less than 300 mg/l TDS) have been established which have encouraged salt source control programs at both Buellton and Solvang where past mineral increments have ranged from 500-700 mg/l TDS.

11. Flood protection and disinfection facilty improvements recommended for Solvang will improve reliability of the winter percolation operations at this facility.

12. Sludge disposal problems associated with these small facilities are negligible in view of the availability of land for dewatering and safe disposal.

13. Air quality, noise emissions, energy use and traffic impacts associated with the recommended plans are negligible; however, the treatment plant and disposal site locations displace riparian habitats along the Santa Ynez River.

14. Sewering programs for the community of Upper Santa Ynez and septic tank management district formation for remaining unsewered areas within this community will be beneficial; however, construction of an interceptor sewer to Solvang may be growth accommodating along the pipeline route.

Mitigating factors have been identified with the impacts described above and in discussions of groundwater quality concerns in other sub-basins having similar impacts (e.g., Santa Maria, Morro Bay and the Gilroy-Hollister area). Where groundwater pumping can be reduced by seasonal use of effluents for irrigation, additional benefits and mitigation of potential adverse impacts due to nitrogen can be obtained; should nitrates become a problem threatening groundwaters, the removal of nitrate could be accomplished; however, agricultural fertilizers and local geology may influence the reported high nitrate content (15 mg/l) of local groundwater more than the small discharges at Buellton and Solvang.

Long term productivity is affected by recommendations concerning protection of local groundwaters; riparian habitats are not greatly affected by these discharges since the ultimate destination of most municipal wastewater within the Santa Ynez River system is to groundwater. The Vandenberg Air Force Base ocean disposal facility will not adversely affect longterm productivity so long as treatment and disposal are conducted in a manner consistent with the State Ocean Policy.

Irretrievable or irreversible commitments of resources, as with other facility plans, are largely associated with construction and operation of these utilities since potential degradation of resources would be prevented by recommended actions.

Growth related aspects pertain to accommodation of growth where sewerage facilities are adequate and where pipeline routes may encourage changes in land use from agriculture to urban development. This possibility is avoided in the area between Buellton and Solvang by retention of separate facilities.

Santa Barbara Coastal Sub-Basin

Environmental impact of municipal wastewater facilities in the Santa Barbara coastal area are associated with effluent disposal to ocean waters along the Santa Barbara Channel. Dischargers include the Goleta Sanitary District, the City of Santa Barbara, Montecito Sanitary District, Summerland Sanitary District and Carpenteria Sanitary District. Environmental impacts include:

1) Upgrading of treatment at Santa Barbara and Goleta S.D. will have beneficial impacts on quality of ocean waters, principally related to

maintenance of acceptable bacteriological quality and compliance with aesthetic factors such as floatables in the warm waters of this popular recreational area. The present flow at Goleta is about 6 mgd; Santa Barbara discharges about 8 mgd.

2) Improvements of the older outfall at Santa Barbara and extensions to outfalls at Summerland S.D. (.1 mgd) and Carpenteria S.D. (.5 mgd) will increase reliability of compliance with dilution provisions of the State Ocean Policy. The Montecito plant has a capacity of 0.7 mgd; some improvements are needed to increase reliability.

3) Continued reliance on ocean disposal in this area could raise questions concerning long-term effects on marine life; thus far, dischargers located along this coastal zone have not produced any ill effects that are documented. However, the importance of recreational beaches and the warm waters of this area require a high level of protection from contamination. Upgraded treatment with reliable disinfection and source controls of toxicants are viewed as positive controls assuring future protection from treated sewage disposal practice to ocean waters in this urbanized coastal area. Urban drainage factors are viewed as a locally important source of contaminants.

4) Reclamation projects may be accommodated by these plans; however, like the South San Luis Obispo County Region, such projects are not developed as a part of the water quality control plan. Local use of effluents for irrigation water in the Goleta vicinity should not be discouraged by the recommended plan since effluents could be transported to irrigation areas if the costs of conveyance justify such a project. Water balance is likely to become a major factor in future growth of the Santa Barbara Coast and reclamation projects will probably be justified as costs of imported water rise.

5) Sludge production will increase as treatment plants are upgraded and expanded to accommodate growth; the developed urban complex along this coast will force sludge disposal by transport to other areas or incineration depending on local economic factors. Sludge disposal will be a problem for this urbanizing area; however, the recommended plans do not create any sludge disposal situations involving unusual practices.

6) Air quality, noise emission, energy use and traffic impacts are more significant in the urbanized area since treatment facilities will not be so well buffered from the urban scene. Traffic increases may involve sludge handling through urban areas to disposal sites or farmland.

Mitigation is not a major concern for these plans since questions of ocean disposal relative to quality of recreational waters and effects on marine life are addressed by upgraded treatment, source control and outfall improvements. Reclamation is not precluded, and as suggested is expected to be utilized more fully as water supplies in this area become growth limiting.

Long-term productivity and irreversible resource commitments are probably related more to water quantity than to water quality.

Surface waters have been imported from the Santa Ynez River and may eventually be brought into this area as part of the California water project. While the Santa Barbara coastal area remains a water deficient area, wastewater reclamation projects may soon be feasible for salinity repulsion or local irrigation purposes and, depending on State Department of Health constraints, may eventually lead to recycling to public water supplies directly or indirectly through recharge of local groundwater aquifers. However, regardless of wastewater reclamation, new water sources will have to be developed for this area if urban growth is to continue. Thus, water supply related factors influence growth more than direct water quality control features of the recommended plan for this sub-basin.

Industrial Wastewater Management

Since EPA regulations which have not yet been published will specify the meaning of "best practicable treatment" in terms of industrial waste constituents, it is premature to judge what the impacts of compliance will be. A major impact which may arise is social dislocation where an industry is forced to close due to the economic impact of implementation of stricter water quality control measures. So many of the industrial waste guidelines suggest "no discharge" the effect on industry will be generally dependent on the feasibility of land disposal or possible hookup to a municipal treatment plant. Few technical reports were filed by the industries of this basin; accordingly little data is available for the assessment of existing impacts.

Solid Waste Management

Digested sewage sludges and grit will be a product of waste treatment facilities proposed by the recommended plans. Sludges will generally be dewatered on site. Possible adverse impacts of sewage sludge disposal are related to odor, nuisance insects, visual impacts, aesthetics and public health concerns; however, sludges can be recycled for beneficial use. See Chapter 5. The quantities of sludge generated will increase in proportion to population and treatment level. Where chemical sludges are produced, disposal problems can be more difficult.

In some areas disposal of sludges will require appropriation of new disposal sites in addition to those which are presently being used. Adverse impacts which may be anticipated at these sites include preemption of alternative land uses, displacement of existing users, destruction of vegetation and wildlife habitat, leachate contamination of surface water and groundwater qualty, degradation of scenic views and aesthetic impacts, and vehicular congestion on access roads. On the other hand, opportunities for the beneficial reuse of solid wastes include the production of methane gas or processing after digestion which may be used to produce soil conditioners which improve the texture and fertility of deficient soils. Both of these potential users are practicable on a regional scale. California law requires that studies be undertaken in each County before January 1, 1976, in order to locate disposal sites which will have the least adverse environmental impact as well as to determine the nature and location of feasible opportunities for beneficial reuse. Project level EIRS should include a detailed consideration of this aspect of facilities planning. When solid waste disposal is implemented at a chosen site, a systematic monitoring program should be implemented in order to determine the effects on the quality of local surface and groundwaters. If nutrient removal facilities are built at the City of San Luis Obispo plant, chemical sludges produced will either require recycling or will have to be hauled to the Santa Maria Valley since there is no Class I dump in the San Luis Obispo area.

Perhaps the more major impacts from solid waste proposals in the plan are the greater emphasis given to stronger institutional controls and the need for new Class I dump sites in some areas. Greater control and more surveillance of these operations should mitigate adverse impacts usually associated with solid waste sites.

Urban Runoff Management

In addition to the problems of flooding, uncontrolled or inadequately controlled urban runoff is believed responsible for serious adverse impacts on the aquatic environment, particularly with regard to such contaminants as toxic heavy metals, persistent pesticides and pcbs (polychlorinated biphenyls). Less serious impacts result from contributions of floatables, sediments, bacteria, other chemicals, oil and grease. All of these impacts will increase in severity as urban growth continues. Urbanized areas are expected to double in size in the southern basin before year 2000.

General approaches to controlling urban sources of receiving water degradation are proposed which should reduce these adverse impacts to a more acceptable level. The first two approaches, source control and improved street cleaning techniques, will produce the benefits of cleaner air and more attractive, healthful surroundings for communities in which they are implemented, as well as alleviating adverse impacts in the receiving waters.

The approach which utilizes abandoned sewage treatment plants for the purpose of treating urban runoff will have no corollary effect since no new structures will be required.

The fourth approach appears to provide the most effective means of dealing with both problems at the same time: urban runoff quality and quantity. This approach would tend to produce urban areas which are sensitive to the constraints of the natural environment. Prohibition of urban developments in environmentally sensitive areas such as the headwaters of drainage basins and practices such as the use of permeable surfaces in urban areas will allow natural processes to continue with less undesirable interference. For example, more natural percolation of waters into the soil will occur with resultant reductions in flood frequency and severity, reduction in erosion problems, reduction of the need for expensive flood control measures, and the restoration of natural moisture content to soils.

Agricultural Wastewater Management

If strong land use controls, including limits on agricultural lands, prove necessary in order to control agricultural wastewater loads adequately, then significant social and economic impacts will be felt. The ultimate effect will be the withdrawal of land resources from agricultural use and associated losses of potential crop production and increased operational costs of dairies and feedlots. Secondary impacts will include losses of employment, income, tax base, and the resultant loss in the overall productivity of the affected region.

These potential effects may prove too costly when compared to the benefits of improved surface and groundwater quality. Less limiting measures such as improved manure storage and handling operations, the designation of salt sinks, increasing natural infiltration, maximizing recharge opportunities, restricting the use of reclaimed waters to existing agricultural lands, and the use of deeper aquifers as a source for water for irrigation and other purposes are expected to yield beneficial effects wtih few adverse consequences.

Individual Treatment Systems

It is recommended that individual treatment systems by retained in several areas prior to the establishment of the fact that problems exist which can only be corrected by sewering. Areas which are presently unsewered and where such problems may occur in the future include Los Osos-Baywood, Nipomo and Santa Ynez. Several measures are proposed which should be implemented in order to solve immediate problems with existing systems. They include enforced maintenance and pumping schedules, corrections to plumbing or leach fields, and in-the-home water conservation measures. Where new construction is occurring, the following physical constraints should be considered in determining the advisability of reliance on septic tanks: depth of water table, depth of soil, ground slope and presence of water sources. In general, new septic tank systems should be limited to developments with a minimum parcel size of 1 acre except where soil and other physical conditions are particularly favorable. Subdivisions based on parcel sizes less than one-helf acre should be sewered regardless of other considerations. If these recommendations are adopted and enforced as SWRCB policy, the retention of septic tank systems in affected areas will have the effect of limiting growth.

In the Los Osos-Baywood Park community a study relative to sewering is proposed. Engineering studies should be implemented to yield data on the characteristics of the two groundwater basins which are believed to underlie the area. If septic tanks turn out to be the best option for Los Osos-Baywood, then they should be placed such that the waste fields leach into the groundwater basin containing the lowest quality water. If the engineering study findings indicate that degradation of groundwater quality will occur, then septic tanks should be prohibitied. Septic tank management approaches should help maintain workable individual systems in unsewered areas.

The result of this study will be the avoidance of nitrate and TDS buildups in a groundwater basin of excellent quality, the prevention of public health hazards generated by the contamination of groundwaters, the surfacing of septic tank fields and backups of sewage into individual homes.

Similar studies should be undertaken in San Lorenzo Valley, Carmel Valley, Santa Yzez and Nipomo. Groundwater quality in these areas is already severely degraded and the contribution from these small communities is believed to have low overall significance. However the basic problems faced are the same in all these areas.

The recommended plan calls for the phasing out of septic tanks and the sewering of all areas where problems can be documented and where projected future population densities warrant it.

Construction, Mining and Logging Activities

Controls on earth disturbance due to construction, mining and logging activities will be beneficial to stream habitats where silt and other debris disrupt sensitive habitats such as spawning areas. In some cases controls necessary to prevent stream degradation could be so strict as to curtail use of conventional construction, mining, or logging practices. Methods to abate problems can involve costly procedures and may require follow-up to mitigate damage resulting from soil, disturbance or mining residues. Adherence to strict con-controls may have social impacts due to elimination of some activities; however compliance with stricter controls could imply more employment to imple-trols could imply more employment to implement revised practices. Road construction and oil extraction related activities would be affected most. Offshore oil drilling has already been affected by stricter standards imposed in lease areas following the Santa Barbara Oil Pollution incident in 1969. Stricter monitoring recommended in the basin plan will be beneficial and should provide data on environmental effects of oil related activities and natural seeps in the Santa Barbara Channel.

Chapter 7 Surveillance and Monitoring

The effectiveness of a water quality control program cannot be judged without the information supplied by a comprehensive surveillance and monitoring program. A plan which calls for the establishment of such a program is set forth in this chapter. The chapter contains a discussion of the objectives of the program, a description of the various elements of the program, and finally, the recommended surveillance and monitoring program.

The State's Surveillance and Monitoring Plan is designed to assure the collection of data necessary to: (a) establish and review water quality standards, goals, and objectives; (b) prevent water quality degradation; (c) determine maximum daily loadings, waste load allocations, and effluent limitations; (d) perform segment classifications and ranking; and (e) establish the relationship between water quality and individual point or non-point sources of pollutants. These data must be verified and properly interpreted to evaluate water quality trends and to make the necessary changes in the enforcement and/or planning programs to carry out program objectives. Output based upon data obtained from this program will be used to prepare reports satisfying the requirements of Sections 104, 106, 208, 301, 303, 304, 305, 307, 308, 314, and 402 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and the applicable portions of the State's Porter-Cologne Water Quality Control Act.

Although not addressed in detail in this chapter, it should be noted that specific requirements with respect to laboratory certification and reporting water quality data to EPA in STORET compatible form must be complied with as a part of the surveillance and monitoring program. Draft federal regulations require that compliance monitoring data be made available to EPA within 90 days after it is acquired. Intensive survey data will be made available within six months after completion of each survey. Data from the primary network and the groundwater network should be made available to EPA within 90 days after it is collected.

PROGRAM OBJECTIVES

The overall objectives of an adequate surveillance and monitoring program are:

1. To measure the achievement of water quality goals and objectives specified in the plan set forth in this report.

2. To measure specific effects of water quality changes on the established beneficial uses.

3. To measure background conditions of water quality and long-term trends in water quality.

4. To locate and identify sources of water pollution that pose an acute, accumulative, and/or chronic threat to the environment.

5. To provide information needed to relate receiving water quality to mass emissions of pollutants by waste dischargers.

6. To provide data for determining waste discharger compliance with permit conditions.

7. To measure waste loads discharged to receiving waters and to identify the limits of their effect, and in water quality segments, prepare waste load allocations necessary to achieve water quality control.

8. To provide the documentation necessary to support the enforcement of permit conditions and waste discharge requirements.

9. To provide data needed to carry on the continuing planning process.

10. To measure the effects of water rights decisions on water quality and to guide the State Board in its responsibility to regulate unappropriated water for the control of quality.

11. To provide a clearinghouse for the collection and dissemination of water quality data gathered by other agencies and private parties cooperating in the program.

12. To prepare reports on water quality conditions as required by federal and state regulations and other users requesting water quality data.

PROGRAM TASKS

A necessary and sufficient surveillance and monitoring program will provide for collection and analysis of samples and the reporting of water quality data. It will include laboratory support and quality assurances, storage of data for rapid and systematic retrieval, and the preparation of routine reports and data summaries. The taking of photographs and remote sensing of pollutant concentrations is included. The current program to carry out the requirements for surveillance and monitoring is made up of eleven tasks. Appendix D provides a detailed description of these tasks and their characteristics. The tasks are:

1. Primary Network
2. Compliance Monitoring
3. Complaint Monitoring
4. Self-Monitoring
5. Intensive Surveys
6. Non-point Sources Investigation
7. Aerial Surveillance
8. Lake Surveillance
9. Annual Water Quality Inventory
10. Surveillance System Design
11. Groundwater Network

SURVEILLANCE PROGRAM

The State's present surveillance and monitoring program does not meet the objectives set forth above. The establishment of an optimal program will require considerable study. Implementation will require time and funds. An optimum surveillance and monitoring program cannot be defined specifically and will require flexibility as the water quality control plan is implemented. This factor is recognized in the draft federal regulations (40 CFR 35, Appendix A) which require the surveillance and monitoring plan be reviewed and updated on an annual basis. The State Board has developed a strategy for implementation of the statewide surveillance and monitoring program which will be used to guide program development. In view of this, the recommended program, as described below, will lead to the optimum system to be implemented in annual increments at a rate intended to meet minimum requirements of federal regulations.

Presently, the best judgment on the optimum system is the program described in Appendix D to this report. This program was developed by the Regional Board and represents the system that the Board believes is necessary to carry out the program objectives. It is intended that the development of the program and the annual program updates will be a stepwise approach to the Appendix D system to be accomplished in about five years from date of adoption of the Basin Plan.

The surveillance and monitoring program will be implemented by the State and Regional Board with the objective to progress systematically toward satisfaction of the January 1, 1977 requirements specified in draft federal regulations. In selecting sampling points, maximum use will be made of stations and data that are now a part of the program of other federal, state, and local agencies with whom cooperation has been agreed upon or favorably discussed. Such a program is composed of the following tasks:

1. Primary Network. The primary monitoring network for the Central Coastal Basin will be composed of ambient freshwater sampling stations, estuarine sampling stations, and marine sampling stations. The primary network will have only a small number of permanent fixed location water quality trend evaluation stations in each basin. If additional stations, parameters, or frequencies are required in the primary network, contractual funds will be budgeted by the State Board.

a. Freshwater Stations

The fresh surface water stations listed in Table 7-1 are essentially those identified by the California Department of Water Resources as their F.Y. 1973-74 surface water quality monitoring program. These stations will be the foundation of the Board's surface water monitoring program for the first year, and contingent upon funding, will be increased each year in accordance with the plan identified in Appendix D.

Areas not covered by the present Department of Water Resources monitoring program will be supplemented by other state, local, or federal data sources, many of which are identified in Appendix D.

b. Estuarine Stations

The first year of implementation of the estuarine primary monitoring network will rely heavily on compliance monitoring and discharger self-monitoring as required by the State Board's "Policy for the Enclosed Bays and Estuaries of California". Ongoing bacteriological sampling by state and local health officials and data collected by various other agencies will be used if applicable (see Appendix D). Various estuaries throughout the State currently have or have had different monitoring programs. These programs

Table 7-1. Central Coastal Basin Fresh Water Monitoring Network[a]

Station I.D. numbers and name	Coordinates: Lat.	Coordinates: Long.	Coordinates: USGS No.		In storet[c]	Start of record: Quan.	Start of record: Qual.	Number of analysis in DWR data bank	Sample frequency: Quan.	Sample frequency: Qual.	Agency sampling: Quan.	Agency sampling: Qual.	Parameters analyzed: Minerals	Trace elements	Nutrients	Pesticides	Miscellaneous	Minor elements Group I	Minor elements Group II
Surface waters																			
D-0- 1100 .00[b] Branciforte C. @ Santa Cruz	36-58.0	121-01.7	11-16	15.00	No	1-40	3-70	<30	Daily stage	Semi-ann.	USGS	CHD	B[d]		B,D[e]		B,D		
D-0- 1180 .01 San Lorenzo Rv. @ Paradis Park	37-00.7	122-02.5					9-69	34		Semi-ann.		DWR	D		B,D		B,D		
D-0- 1220 .01 Zayante Ck. @ Felton	37-02.9	122-04.0					3-70	<30		Semi-ann.		CHD	B		B,D		B,D		
D-0- 1498 .01 San Lorenzo Rv. @ Boulder Ck.	37-12.4	122-08.6	11-16	00.20		10-68	3-70	<30	Cont.	Semi-ann.	USGS	CHD	B		B,D		B,D		
D-0- 4010 .01 Scott Ck. @ Hwy 1 nr Davenport	37-03.6	122-13.7	11-16	20.00		2-39	3-70	<30	Cont.	Semi-ann.	USGS	CHD	B		B,D		B,D		
D-0- 1250 .00 Pajaro Rv. nr Chittenden	36-54.0	121-35.8	11-15	90.00		10-39	12-51	<30	Cont.	Cont.	USGS	DWR	B			B	B		
D-1- 1380 .00 Uvas Ck. nr Morgan Hill	37-04.0	121-41.5	11-15	40.00		12-30	7-52	<30	Cont.	Quar.	USGS	DWR	B			B	B		
D-1- 2450 .00 San Benito R. nr Willow C. School	36-36.5	121-12.1	11-15	65.00		10-39	7-58	<30	Cont.	Semi-ann.	USGS	DWR	B			B	B		
D-2- 1006 .00 Tembladero Slu. @ Merritt L.D.	36-46.3	121-47.2					8-70	<30		Mon.		DWR			D	B	B,D	D	D
D-2- 1016 .50 Salinas Rec. Cnl. @ Alisal STP	36-44.5	121-44.3					10-70	<30		Mon.		DWR				B	B	D	
D-2- 1030 .30 Blanco Drain @ Pumplift	36-42.5	121-44.5					5-70	<30		Mon.		DWR			D	B	B,D	D	D
D-2- 1220 .00 Salinas Rvr. nr Spreckles	36-37.8	121-40.7	11-15	25.00		10-00	4-51	<30	Cont.	Semi-ann.	USGS								
D-2- 1325 .10 Salinas Rvr. nr Gonzales	36-29.2	121-28.1					5-69	<30		Mon.		DWR	B		D	B	B,D	D	D
D-3- 1450 .00 Salinas Rvr. @ Paso Robles	35-37.7	120-41.0	11-14	75.00		10-39	4-51	65	Cont.	Ann.	USGS	DWR	B			B	B		
D-3- 2215 .00 San Antonio R. nr Lockwood	35-53.8	121,05.2	11-15	00.00		10-65	7-58	<30	Cont.	Semi-ann.	USGS								
D-3- 3520 .00 Nacimento R. nr San Miguel	35-47.0	120-47.4	11-14	95.00		10-39	7-58	<30	Cont.	Semi-ann.	USGS								
D-4- 1200 .00 Carmel R. @ Robles Del Rio	36-28.5	121-43.6	11-14	32.00		8-57	1-59	<30	Cont.	Semi-ann.	USGS	DWR	B				B		
D-6- 3050 .00 Cuyama Rv. blw Twitchell Dm.	34-56.7	120-17.5	11-13	81.00		1-59	10-58	53	Cont.	Quar.	USGS	DWR	B,D						
D-8- 1440 .00 Santa Ynez R. @ Solvang	34-35.1	120-08.6	11-12	85.00		10-28	4-51	138	Cont.	Quar.	USGS	DWR	B,D					B	D
D-8- 1565 .00 Lake Cachum nr Santa Ynez	34-35.9	119-58.8	11-12	55.00		10-52	4-58	138	Daily stage	Quar.	USBR	DWR	B,D			B		B	D
D-0- 2020 .00 Aptos C. bl Valencia Ck.	36-58.4	121-54.0	11-15	97.50		11-36	3-70	<30	Cont.	Semi-ann.	USGS	CHD	B		B,D		B,D		
D-0- 3100 .00 Soquel Ck. @ Soquel	36-59.5	121-57.3	11-16	00.00		5-51	12-51	178	Cont.	Semi-ann.	USGS	CHD	B,D		B,D		B,D		
D-2- 1850 .00 Salinas R. nr Bradley	35-55.7	120-52.0	11-15	05.00		12-48	10-58	66	Cont.	Semi-ann.	USGS	DWR	B,D			B	B		
Ground water																			
3- 01.00 -01 Soquel Valley													D						
3- 02.00 -305 Pajaro Valley													B,D						
3- 03.01 -83 South Santa Clara Valley													B,D						
3- 03.02 -170 San Benito County													B,D						
3- 04.01 -243 Pressure Area													B,D						
3- 04.02 -49 East Side Area													B,D						
3- 04.03 -53 Forebay Area													D						
3- 04.04 -12 Arroyo Seco Cone													D						
3- 04.05 -97 Upper Valley Area													D						
3- 04.06 -14 Paso Robles Basin													B,D						
3- 04.08 -47 Seaside Area													D						
3- 04.09 -09 Langley Area													D						
3- 04.10 -27 Corral de Tierra Area													D						
3- 07.00 -63 Carmel Valley													D						
3- 26.00 - West Santa Cruz Terrace																			
3- 09.80 -248 Paso Robles													B,D			B			
3- 09.90 -06 Pozo Hydrologic Subunit													D						
3- 10.10 -116 Cambria													B,D						
3- 10.20 -177 San Luis Obispo													B,D			B		B	
3- 10.30 -214 Arroyo Grande													B,D			B		B	
3- 11.00 -68 Carrizo Plain													B,D						
3- 12.10 -186 Santa Maria													B,D			B			
3- 12.20 -11 Sisquoc													B,D						
3- 12.30 -169 Cuyama Valley													B,D						
3- 13.00 -76 San Antonio													B,D						
3- 14.10 -245 Lompoc													B,D			B		B	
3- 14.20 -51 Santa Rita													B,D						
3- 14.30 -13 Buellton													B,D						
3- 14.40 -40 Santa Ynez													B,D						
3- 14.50 -07 Headwater																			
3- 15.10 -62 Arguello Hydro Unit																			
3- 15.30 -159 South Coast																			

a State Water Resources Control Board.
b System explained in Department of Water Resources Bulletin No. 130 series.
c EPA national data management program.
d Data recorded in DWR Bulletin No. 130-71.
e Data in DWR file.

will be reviewed in light of federal regulations and augmented as funds become available.

Only two estuaries in the state (Humboldt Bay and San Francisco Bay) will be sampled in F.Y. 1974-75. Additional stations will be added each year until the desired number of stations have been attained. The parameters will be grouped into four classes: water, sediment, biota, and aerial surveillance.

c. Marine Stations

The first year of implementation of the marine primary monitoring program will rely heavily on compliance monitoring and discharger self-monitoring required by the State's Ocean Plan and in the "Guidelines For Technical Reports and Monitoring Programs". Ongoing bacteriological sampling conducted by state and local health officials and data collected by other agencies will be used if applicable (see Appendix D). In addition to these programs, sites in certain of the Areas of Special Biological Significance (ASBS) designated by the State Board have been selected for fixed station monitoring as a part of the primary monitoring network. These stations will be monitored for the determination of background levels of pollution, base line quality conditions, and identification of biological populations.

This initial program contains only six marine sampling locations throughout coastal California. Analytical parameters are divided into four classes: water, sediment, biota, and aerial surveillance. Biotic sampling for chemical residue (i.e., pesticides and heavy metals) will be by far the most costly and therefore, some of the recommended groups of organisms may not be sampled if the costs for this phase of the program do not prove to be cost effective.

2. Compliance Monitoring. This task will determine permit compliance, validate self-monitoring reports, check receiving water standards compliance, and provide data for enforcement actions. The data obtained will be added to the supply of water quality data for regulation, enforcement, planning, and facilities development activities. Discharger compliance monitoring and enforcement actions are the responsibility of, and will normally be carried out wholly by, the Regional Board staff. Standards Compliance Monitoring will be coordianted by the State Board and use data available from other program tasks.

The scope of the Waste Discharger Compliance Monitoring Program for the basin will be dependent on the number and complexity of Waste Discharger Requirements (NPDES and other Permits) issued by the Regional Board. Waste discharge requirements may or may not include a specific discharger self-monitoring and reporting requirement on the effluent and receiving waters.

The specific details of this program will be developed and included in the monitoring strategy as the waste discharge requirements are issued and after applicable federal reporting requirements are final.

In the interim, this program will include a control procedure whereby each discharger is periodically visited by Regional Board personnel on both an announced and an unannounced "Facility Inspection" basis. The intent of announced visits will be to work with the discharger through personal contact and communication to review his procedures in order to assure quality control. The intent of the unannounced inspections will be to survey the operation; inspect the discharge area; and collect, check, or reference samples.

3. Complaint Monitoring. The Complaint Monitoring task involves investigation of complaints of citizens and public or governmental agencies on the discharge of pollutants or creation of nuisance conditions. It is a Regional Board responsibility which includes preparation of reports, letters, or taking other follow-up actions to document observed conditions and to inform the State Board and complainant and discharger of the observed conditions.

4. Self-monitoring. Discharger self-monitoring reports generated as a result of permits and waste discharge requirements will be collected and reviewed by the Regional Board for obvious errors or omissions and entered into the data bank for checking. Significant reports of noncompliance will be made immediately upon detection. Other data desired by the Regional or State Board will be rendered on a routine basis. Self-monitoring reports are normally submitted by the discharger on a monthly or quarterly basis as required by the permit conditions. A list of dischargers from which self-monitoring information is required is contained in Table 7-2. The plan is to continue this program at its present

Table 7-2. Dischargers with Monitoring Programs[a]

Airox, Inc.
Allied Foods
Almaden Vineyards (Pac.)
Almaden Vineyards (Holl.)
Apple Growers Ice
Aptos County Sanitary District
Aquaculture Enterprises
ARCO Oil Co., Ellwood Onshore Facility
Atascadero County Sanitary District
Atascadero Garbage District
Atascadero State Hospital
Aurignac, Albert P.
Avila Sanitary District

B & P Packing
Barkley Petroleum (San Ardo)
Bear Creek Estates
Ben Lomond Conservation Facility
Ben Lomond Solid Waste
Bettencourt Dairy
Big Basin State Park
Big Basin Woods
Big Sur State Park
Black Lake Country Club
Black Lake Estates Mobile Home Park
Boulder Creek Golf Club
Brookdale Condominium
Bryan Meat Co.
Buellton County Sanitary District
Buena Vista Garbage & Refuse
Buena Vista Migrant Camp
Buena Vista Mines
Burreson Petro-Gas

Cachuma Sanitary District
Cal-American Water
Cal-American Water (Schulte)
California Men's Colony
Cal Poly Project Dairy
Cal Poly State Dairy
Cal Poly Swine Unit
Cambria County Water District
Cambria Garbage District
Campbell Soup Company
Camp Roberts (National Guard)
Camp San Luis Obispo Solid Waste
Cantinas Campground
Capitola Berry Farms
Capurro, Frank
Carmel Highlands Property
Carmel Sanitary District
Carpinteria Sanitary District
Casmalia Disposal Site
Castroville County Sanitary District
Cate School
Chualar Sanitary District
Cold Canyon Landfill
Corps of Engineers, Morro Bay
County Care Convalescent Hospital
Crazy Horse Solid Waste
Cuesta Mobile Home Park
Cuyama Valley Community Inc.

Daisy Hill Mobile Home Park
D'Arrigo Bros. Co.
Davenport Sewer Maintenance District
Dexter Dairy
Domenghini Trust Dairy
Doolittle Property Solid Waste
Dune Lakes Mobile Homes

East Cliff Sanitary District
Elkhorn Farms

Fairway Manor
Fat City Cattle
Federal Correctional Institute
Firestone Tire Co.
Fundamental Evangalestic Association

Galaxy Park Mobile Home Subdivision
Gilroy-Morgan Hill
Gilroy Industrial
Goleta County Water District (La Vista Filter Plant)
Goleta Sanitary District
Gonzales, city of
Gonzales Potato Company
Granite Canyon Marine Laboratory
Granite Rock Co. - Logan
Granite Rock Co.
Greenfield, city of
Grefco, Inc.
Growers' Ice & Development
Guadalupe, city of
Guy F. Atkinson

Hambey & Sons, Inc.
Happyland Subdivision
Harden Farms - Monterey
Harden Farms - San Benito
Harold Green Mobile Home Park
Hendrik de Boer Dairy
Heritage Ranch Solid Waste Disposal
Hidden Hills Mobilodge
Highlands Inn
Hillsdale Rock Co. - Hollister
Hillsdale Rock Co. - San Juan Bautista
Hoffman, Henry E. Company
Hollister Airport
Hollister, City of
Hollister Industrial
Hollister - San Benito Refuse
Hyla Oil

Indian Springs Ranch
Inglis Frozen Foods
Inter-Harvest
I.V.R. Hog Farm

Kaiser Refractories
Kaiser Sand & Gravel - Santa Cruz
Kaiser Sand & Gravel - Santa Margarita
King City, city of
King City Airport

[a] Municipal Dischargers are located in Fig. 5-1 appearing in Chapter 5

Table 7-2. Dischargers with Monitoring Programs[a]

King City Oil Field
Kroc, Ray A. Ranch

Laguna County Sanitary District
Lamplighter Los Osos Mobile Home Park
Las Tablas Hunt Club
Let-Us-Pak
Lewis Road Sewage Waste Disposal
Liquid Ice Co.
Little Bear Water Co.
Lompoc & Lompoc Regional
Lompoc Utilities Services
Lone Star Industries
Lopez Recreation Area
Los Berros Feeders
Los Robles Mobile Homes
L.R. Gularte & Sons Dairy

Maggio Vegetable
Mann Apple Processing
Mann Packing Company
Marina County Water District
Marinovich Inc.
McFarland Energy
Merchants Refrigerating Co.
Mesa Dunes Mobile Home Estates
Minhoto & Silva Dairy
Mission Belle Diary
Montecito Sanitary District
Monterey, City of
Monterey Bay Academy
Monterey County Solid Waste Disposal Sites
Monterey Dunes Colony
Moon Glow Dairy
Morro Bay - Cayucos
Mountain Brook Mobile Home Park
Mustang Village Mobile Home Park

Nacimiento Lake Resort (Sewerage)
Nacimiento Lake Solid Waste Disposal Site
New Klau Mine
Nipomo Palms Mobile Home Park
North Shore Ski & Boat Club

Oak Hills Subdivision
Oak Shores Development
Old College Dairy
Olive Springs Quarry
Ormonde Mobile Home Park
Oshita, Inc.
Owens - Illinois, Inc.
Ozena Valley Refuse

Pacific Grove, City of
Pacific Lighting Service Co.
Paso Robles, City of
Paso Robles School for Boys (C.Y.A.)
Paso Robles Solid Waste Disposal
People's Self-Help Housing
Pescadero Solid Waste Site
PG&E Co. - Diablo Canyon
PG&E Co. - Morro Bay
PG&E Co. - Moss Landing
Phillips Petroleum Co.
    Petroleum
    Tijiguas Shore Site
Pismo Beach, City of
Puregro Co.

Ragged Point Inn
Rancho Colina Mobile Home Park
Rancho de la Vida MHP
Rancho La Scherpa
Rancho Morro Mobile Home Park
Richfield Oil Co. - Cuyama
    Coal Oil Point
Rider Apple Processing
Ridgemark Estates Subdivision
Roemer Dairy
Rolling Green (Scotts Valley)
Rolling Woods Subdivision

Sackman Hog Farm
Salinas, City of
    Alisal Plant
    Industrial
    Main Plant
Salinas Utilities Service
Salinas Valley Feed Yard
San Antonio Lake Water Treatment Plant
San Antonio Reservoir, North and South
San Antonio Solid Waste Disposal Site
San Ardo, City of
San Benito County Hospital
San Juan Bautista, City of
San Lorenzo Valley County Water District
    (Bear Creek)
San Lorenzo Valley County Waste Disposal
San Luis Bay Properties
San Luis Bay Properties Solid Waste
San Luis Obispo, City of
San Luis Obispo Schools
San Martin Solid Waste
San Miguel Sanitary District
San Simeon Acres
Santa Barbara, City of
Santa Barbara Harbor Inprovement, City of
Santa Cruz Aggregates
Santa Cruz Canning
Santa Cruz, City of
Santa Cruz Filter Plant
Santa Cruz Service Area #5
Santa Cruz Solid Waste
Santa Margarita School
Santa Maria, City of
Santa Maria Airport
Santa Maria Solid Waste
Santa Ynez Solid Waste
Santa Ynez Valley Golf Club & Ranch Estates
Santa Ynez Winery
Scotts Valley Circuits, Inc.
Scotts Valley, City of
Sea Products Co.
Seaside County Sanitary District
Servisoft of Salinas
Shell Oil Co.

[a] Municipal Dischargers are located in Fig. 5-1 appearing in Chapter 5

Table 7-2. Dischargers with Monitoring Programs[a]

Molino Gas Plant
Capitan Field
Shippers Development Co.
Signal Oil Company
Elwood Field
Price Canyon
Sinton & Brown
Slack Canyon Conservation Camp
Smuckers - Watsonville
Soil Service, Inc.
Soledad, City of
Soledad Correctional Training Facility
Solvang Municipal Improvement District
South San Luis Obispo Sanitary District
Spiegl Foods
Sporup Sanitorium
Spreckels Sugar Co.
Standard Oil Co.
Carpinteria
Estero Bay
Platforms
Stark Development
Students International Meditation Society
Summerland Sanitary District
Sunbird Mines
Sun Oil Co. - Hill House
Surf Dunes Camp Ground

Tajiguas Solid Waste
Teledyne, Inc.
Texaco, Inc. - Platform Helen
Tres Pinos County Water District
Turri Ranch Road Disposal Site

Union Carbide Corp.
Union Carbide - Caldria Plant
Union Ice Co.
Union Oil Co.
Union Sugar Co.
United Feed Yards
Universal Foods
University of California at Santa Barbara
Seawater System
U.S. Air Force
Cambria AFS
Cambria Housing
Vandenberg A.F.B.
U.S. Army - Fort Ord
Aviation
U.S. Forest Service
Los Padres National Forest, Los Prietos

Valley Cooling Company
Valley Potato Co.
Valley Rock & Sand
Vandenberg Village
Ventucopa Sanitary Landfill
Vista de Oro Subdivision

Walti, Schilling Co.
Watsonville, City of
Watsonville Refuse
Western Pacific Services Co. #1
Western Pacific Services Co. #2
Western Refrigerating Co.

[a] Municipal Dischargers are located in Fig. 5-1 appearing in Chapter 5

level, adding to the present list as additional self-monitoring requirements are imposed.

5. Intensive Surveys. Intensive monitoring surveys provide detailed water quality data to locate and evaluate violations of receiving water standards and make waste load allocations. They are usually localized, intermittent sampling at a higher than normal frequency. These surveys are specially designed to evaluate problems in water quality class segments, areas of special biological significance, or hydrologic units requiring sampling in addition to the routine monitoring programs. Surveys are repeated at appropriate intervals depending on the parameters involved, the variability of conditions, and changes in hydrologic or effluent regimes.

6. Non-point Source Investigations. The available information on non-point sources of pollution and abatement thereof is scarce and indicates wide ranges of variability. The objective in this task is to (a) identify location of the sources of non-point pollutants; (b) develop information on the quantity, strength, character, and variability of non-point source pollutants; (c) evaluate the impact on the receiving water quality and biota; (d) provide information useful in the management of non-point source pollution; and (e) monitor the results of any control plan. Six categories of non-point source pollution have been defined in PL 92-500, Section 304: (a) agriculture and silviculture, (b) mining activities, (c) construction activities, (d) disposal underground, (e) saltwater intrusion, and (f) hydrographic modification. The identification of areas needing investigation will be defined in other chapters of this plan. Investigations will be undertaken on a statewide priority basis.

Specific non-point source investigations are identified in the Basin Plan and monitoring of other non-point source pollutants will be done as part of the intensive surveys task. Should plan updates recognize the need for such information or recommend establishment of non-point control actions, a monitoring plan addressed to the requirements under this task will be implements.

7. Aerial Surveillance. The need and usefulness of aerial surveillance has been demonstrated in a pilot study carried out by the State Board over the past two years. As a result of the study in which several alternatives were investigated, the State Board has established an aerial surveillance program which will be adequate to meet the needs for the foreseeable future.

The aerial surveillance program is administered and implemented by the State Board and will be carried out by State Board staff. A total of 800 air-hours/year has been provided with activities scheduled as follows:

Special Studies for Regions	200 hours
Special State Board Functions	125 hours
Emergency Responses	25 hours
Development of Aerial Surveillance Methods	25 hours
Routine Surveillance for Regional Boards	425 hours

Flights are made primarily to gather photographic records of discharges and water quality conditions obtained from low altitude passes over the area. Procedures will be developed to catalog photographs and records for rapid retrieval, both at the Regional Board and State Board. The program includes the development and use of remote sensing methods.

8. Lake Surveillance. This element is responsive to the requirements set forth in Section 314 of PL 92-500 and applicable federal regulations. The State is required to identify and determine the present trophic conditions of all publicly owned freshwater lakes. The lakes inventory must be updated on a regular basis to include additional data as it becomes available and to indicate changes in trophic conditions.

An inventory of the lakes of California, without information on trophic conditions, has been completed. It identifies about 5,000 freshwater lakes in California, however, additional information is required on each lake to meet federal requirements. During the first year of this surveillance and monitoring plan, the State and Regional Board staffs, in cooperation with other State agencies, will consolidate available information on the lakes of California and make initial estimates of their trophic conditions. The data on trophic conditions must be submitted to EPA on January 1, 1975. Additional supportive information will be compiled and submitted to EPA by April 15, 1975 as part of the Annual Water Quality Inventory.

Subsequently, the State will develop specific criteria for determining the trophic condition of its freshwater lakes. Lakes which exhibit noticeable eutrophy or other water quality problems, as determined by comparison with the defining criteria, will be given the highest priority to identify actions necessary to control degradation.

Lake Surveillance information will be useful for enforcement and in developing restoration actions.

9. Annual Water Quality Inventory. Section 305 (b) of PL 92-500, as revised by subsequent EPA guidelines, requires that by April 15, 1975, the State shall prepare and submit to EPA the first of a series of reports which will be called the Annual Water Quality Inventory. This report shall include: (a) a description of the water quality of major navigable waters in the State during the preceding year; (b) an analysis of the extent to which significant navigable waters provide for the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water; (c) an analysis of the extent to which elimination of the discharge of pollutants is being employed or will be needed; (d) an estimate of the environmental impact, the economic, and social costs necessary to achieve the "no discharge" objective of PL 92-500, the economic and social benefits of such achievement and an estimate of the date of such achievement; and (e) a description of the nature and extent of non-point sources of pollutants and recommendations as to the programs which must be taken to control them, with estimates of cost.

Data collection and analyses already being carried out by the State in the permits, planning, facilities, monitoring, and enforcement programs will be utilized in preparing the report on the quality of the waters of California. It will be a single report covering the entire State prepared by the State Board.

10. Surveillance System Design. This task consists of a series of Surveillance System development, implementation, and evaluation related subtasks as listed below:

1. Preparation and revision of Monitoring Strategy.
2. Identification evaluation, and coordination of monitoring requirements.
3. Consulting services for development of new methods and procedures.
4. Evaluation of "State of the Art" techniques in monitoring.
5. Surveillance and monitoring network coordination and design.
6. Monitoring cost estimating and effectiveness rating.
7. Station qualification and network validation.
8. Water qualtiy evaluation, interpretation, and display.
9. Coordination of water quality data handling, storage, and reporting including data available from local agencies.

11. Groundwater Network. Groundwater basins and the groundwater basin numbering system used in Table 7-1 are those indicated in DWR Bulletin No. 130-71. The last two digits in the numbering system have been added to indicate the number of wells reporting sampling in each groundwater basin. Basins wtih the highest priority will be selected on the basis of economic importance and degree of threat to groundwater quality. The first priority subtasks are: designation of principal aquifers, selection of wells for potential inclusion in the groundwater network, and identification of potential pollution sources. The selection of specific wells has not been completed at this writing and will be made when field checks of their availability, suitability, and access can be completed.

SPECIAL APPENDIX

Plans and Policies

I.

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Kerry W. Mulligan
Executive Officer
State Water Resources
Control Board

II.

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

STATE POLICY FOR WATER QUALITY CONTROL

I. FOREWORD

To assure a comprehensive statewide program of water quality control, the California Legislature by its adoption of the Porter-Cologne Water Quality Control Act in 1969 set forth the following statewide policy:

> The people of the state have a primary interest in the conservation, control, and utilization of the water resources, and the quality of all the waters shall be protected for use and enjoyment.
>
> Activities and factors which may affect the quality of the waters shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.
>
> The health, safety, and welfare of the people requires that there be a statewide program for the control of the quality of all the waters of the state. The state must be prepared to exercise its full power and jurisdiction to protect the quality of waters from degradation.
>
> The waters of the state are increasingly influenced by interbasin water development projects and other statewide considerations. Factors of precipitation, topography, population, recreation, agriculture, industry, and economic development vary from region to region. The statewide program for water quality control can be most effectively administered regionally, within a framework of statewide coordination and policy.

To carry out this policy, the Legislature established the State Water Resources Control Board and nine California Regional Water Quality Control Boards as the principal state agencies with primary responsibilities for the coordination and control of water quality. The State Board is required pursuant to legislative directives set forth in the California Water Code (Division 7, Chapter 3, Article 3, Sections 13140 Ibid) to formulate and adopt state policy for water quality control consisting of all or any of the following:

Adopted by the State Water Resources Control Board by motion of July 6, 1972.

I. (continued)

Water quality principles and guidelines for long-range resource planning, including groundwater and surface water management programs and control and use of reclaimed water.

Water quality objectives at key locations for planning and operation of water resource development projects and for water quality control activities.

Other principles and guidelines deemed essential by the State Board for water quality control.

II. GENERAL PRINCIPLES

The State Water Resources Control Board hereby finds and declares that protection of the quality of the waters of the State for use and enjoyment by the people of the State requires implementation of water resources management programs which will conform to the following general principles:

1. Water rights and water quality control decisions must assure protection of available fresh water and marine water resources for maximum beneficial use.

2. Municipal, agricultural, and industrial wastewaters must be considered as a potential integral part of the total available fresh water resource.

3. Coordinated management of water supplies and wastewaters on a regional basis must be promoted to achieve efficient utilization of water.

4. Efficient wastewater management is dependent upon a balanced program of source control of environmentally hazardous substances[1/], treatment of wastewaters, reuse of reclaimed water, and proper disposal of effluents and residuals.

5. Substances not amenable to removal by treatment systems presently available or planned for the immediate future must be prevented from entering sewer systems

1/ Those substances which are harmful or potentially harmful even in extremely small concentration to man, animals, or plants because of biological concentration, acute or chronic toxicity, or other phenomenon.

II. 5. (continued)

in quantities which would be harmful to the aquatic environment, adversely affect beneficial uses of water, or affect treatment plant operation. Persons responsible for the management of waste collection, treatment, and disposal systems must actively pursue the implementation of their objective of source control for environmentally hazardous substances. Such substances must be disposed of such that environmental damage does not result.

6. Wastewater treatment systems must provide sufficient removal of environmentally hazardous substances which cannot be controlled at the source to assure against adverse effects on beneficial uses and aquatic communities.

7. Wastewater collection and treatment facilities must be consolidated in all cases where feasible and desirable to implement sound water quality management programs based upon long-range economic and water quality benefits to an entire basin.

8. Institutional and financial programs for implementation of consolidated wastewater management systems must be tailored to serve each particular area in an equitable manner.

9. Wastewater reclamation and reuse systems which assure maximum benefit from available fresh water resources shall be encouraged. Reclamation systems must be an appropriate integral part of the long-range solution to the water resources needs of an area and incorporate provisions for salinity control and disposal of nonreclaimable residues.

10. Wastewater management systems must be designed and operated to achieve maximum long-term benefit from the funds expended.

11. Water quality control must be based upon latest scientific findings. Criteria must be continually refined as additional knowledge becomes available.

12. Monitoring programs must be provided to determine the effects of discharges on all beneficial water uses including effects on aquatic life and its diversity and seasonal fluctuations.

III. PROGRAM OF IMPLEMENTATION

Water quality control plans and waste discharge requirements hereafter adopted by the State and Regional Boards under Division 7 of the California Water Code shall conform to this policy.

This policy and subsequent State plans will guide the regulatory, planning, and financial assistance programs of the State and Regional Boards. Specifically, they will (1) supersede any regional water quality control plans for the same waters to the extent of any conflict, (2) provide a basis for establishing or revising waste discharge requirements when such action is indicated, and (3) provide general guidance for the development of basin plans.

Water quality control plans adopted by the State Board will include minimum requirements for effluent quality and may specifically define the maximum constituent levels acceptable for discharge to various waters of the State. The minimum effluent requirements will allow discretion in the application of the latest available technology in the design and operation of wastewater treatment systems. Any treatment system which provides secondary treatment, as defined by the specific minimum requirements for effluent quality, will be considered as providing the minimum acceptable level of treatment. Advanced treatment systems will be required where necessary to meet water quality objectives.

Departures from this policy and water quality control plans adopted by the State Board may be desirable for certain individual cases. Exceptions to the specific provisions may be permitted within the broad framework of well established goals and water quality objectives.

May 18, 1972

III.

State Water Resources Control Board

WATER QUALITY CONTROL PLAN FOR CONTROL OF TEMPERATURE IN THE COASTAL AND INTERSTATE WATERS AND ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA[1]

DEFINITION OF TERMS

1. Thermal Waste - Cooling water and industrial process water used for the purpose of transporting waste heat.

2. Elevated Temperature Waste - Liquid, solid, or gaseous material including thermal waste discharged at a temperature higher than the natural temperature of receiving water. Irrigation return water is not considered elevated temperature waste for the purpose of this plan.

3. Natural Receiving Water Temperature - The temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated temperature waste discharge or irrigation return waters.

4. Interstate Waters - All rivers, lakes, artificial impoundments, and other waters that flow across or form a part of the boundary with other states of Mexico.

5. Coastal Waters - Waters of the Pacific Ocean outside of enclosed bays and estuaries which are within the territorial limits of California.

6. Enclosed Bays - Indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays will include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to the following: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Carmel Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

7. Estuaries and Coastal Lagoons - Waters at the mouths of streams which serve as mixing zones for fresh and ocean water during a major portion of the year. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open

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1/ This plan revises and supersedes the policy adopted by the State Board on January 7, 1971 and revised October 13, 1971.

ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and saltwater occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge and appropriate areas of Smith River, Klamath River, Mad River, Eel River, Noyo River, and Russian River.

8. Cold Interstate Waters - Streams and lakes having a range of temperatures generally suitable for trout and salmon including but not limited to the following: Lake Tahoe, Truckee River, West Fork Carson River, East Fork Carson River, West Walker River and Lake Topaz, East Walker River, Minor California-Nevada Interstate Waters, Klamath River, Smith River, Goose Lake, and Colorado River from the California-Nevada stateline to the Needles-Topoc Highway Bridge.

9. Warm Interstate Waters - Interstate streams and lakes having a range of temperatures generally suitable for warm water fishes such as bass and catfish. This definition includes but is not limited to the following: Colorado River from the Needles-Topock Highway Bridge to the northerly international boundary of Mexico, Tijuana River, New River, and Alamo River.

10. Existing Discharge - Any discharge (a) which is presently taking place, or (b) for which waste discharge requirements have been established and construction commenced prior to the adoption of this plan, or (c) any material change in an existing discharge for which construction has commenced prior to the adoption of this plan. Commencement of construction shall include execution of a contract for onsite construction or for major equipment which is related to the condenser cooling system.

    Major thermal discharges under construction which are included within this definition are:

    A. Diablo Canyon Units 1 and 2, Pacific Gas and Electric Company.

    B. Ormond Beach Generating Station Units 1 and 2, Southern California Edison Company.

    C. Pittsburg No. 7 Generating Plant, Pacific Gas and Electric Company.

    D. South Bay Generating Plant Unit 4 and Encina Unit 4, San Diego Gas and Electric Company.

11. New Discharge - Any discharge (a) which is not presently taking place unless waste discharge requirements have been established and construction as defined in Paragraph 10 has commenced prior to adoption of this plan or (b) which is presently taking place and for which a material change is proposed but no construction as defined in Paragraph 10 has commenced prior to adoption of this plan.

12. Planktonic Organism - Phytoplankton, zooplankton and the larvae and eggs of worms, molluscs, and anthropods, and the eggs and larval forms of fishes.

13. Limitations or Additional Limitations - Restrictions on the temperature, location, or volume of a discharge, or restrictions on the temperature of receiving water in addition to those specifically required by this plan.

SPECIFIC WATER QUALITY OBJECTIVES

1. Cold Interstate Waters

   A. Elevated temperature waste discharges into cold interstate waters are prohibited.

2. Warm Interstate Waters

   A. Thermal waste discharges having a maximum temperature greater than 5°F above natural receiving water temperature are prohibited.

   B. Elevated temperature wastes shall not cause the temperature of warm interstate waters to increase by more than 5°F above natural temperature at any time or place.

   C. Colorado River - Elevated temperature wastes shall not cause the temperature of the Colorado River to increase above the natural temperature by more than 5°F or the temperature of Lake Havasu to increase by more than 3°F provided that such increases shall not cause the maximum monthly temperature of the Colorado River to exceed the following:

January	-	60°F	July	-	90°F
February	-	65°F	August	-	90°F
March	-	70°F	September	-	90°F
April	-	75°F	October	-	82°F
May	-	82°F	November	-	72°F
June	-	86°F	December	-	65°F

D. Lost River - Elevated temperature wastes discharged to the Lost River shall not cause the temperature of the receiving water to increase by more than 2°F when the receiving water temperature is less than 62°F, and 0°F when the receiving water temperature exceeds 62°F.

3. Coastal Waters

A. Existing discharges

(1) Elevated temperature wastes shall comply with limitations necessary to assure protection of the beneficial uses and areas of special biological significance.

B. New Discharges

(1) Elevated temperature wastes shall be discharged to the open ocean away from the shoreline to achieve dispersion through the vertical water column.

(2) Elevated temperature wastes shall be discharged a sufficient distance from areas of special biological significance to assure the maintenance of natural temperature in these areas.

(3) The maximum temperature of thermal waste discharges shall not exceed the natural temperature of receiving waters by more than 20°F.

(4) The discharge of elevated temperature wastes shall not result in increases in the natural water temperature exceeding 4°F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

Alternate water quality objectives may be specified in waste discharge requirements if such objectives would assure full protection of the aquatic environment. Such objectives may be specified in waste discharge requirements only after receipt by the regional board of written concurrence from the State Board and the Environmental Protection Agency.

4. <u>Enclosed Bays</u>

A. Existing discharges

(1) Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses.

B. New discharges

(1) Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses. The maximum temperature of waste discharges shall not exceed the natural temperature of the receiving waters by more than $20^{o}F$.

(2) Thermal waste discharges having a maximum temperature greater than $4^{o}F$ above the natural temperature of the receiving water are prohibited.

5. <u>Estuaries</u>

A. Existing discharges

(1) Elevated temperature waste discharges shall comply with the following:

a. The maximum temperature shall not exceed the natural receiving water temperature by more than $20^{o}F$.

b. Elevated temperature waste discharges either individually or combined with other discharges shall not create a zone, defined by water temperatures of more than $1^{o}F$ above natural receiving water temperature, which exceeds 25 percent of the cross-sectional area of a main river channel at any point.

c. No discharge shall cause a surface water temperature rise greater than $4^{o}F$ above the natural temperature of the receiving waters at any time or place.

d. Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

(2) Thermal waste discharges shall comply with the provisions of 5A(1) above and, in addition, the maximum temperature of thermal waste discharges shall not exceed $86^{o}F$.

B. New discharges

(1) Elevated temperature waste discharges shall comply with item 5A(1) above.

(2) Thermal waste discharges having a maximum temperature greater than 4°F above the natural temperature of the receiving water are prohibited.

(3) Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

GENERAL WATER QUALITY PROVISIONS

1. Additional limitations shall be imposed in individual cases if necessary for the protection of specific beneficial uses and areas of special biological significance. When additional limitations are established, the extent of surface heat dispersion will be delineated by a calculated 1-1/2°F isotherm which encloses an appropriate dispersion area. The extent of the dispersion area shall be:

   A. Minimized to achieve dispersion through the vertical water column rather than at the surface or in shallow water.

   B. Defined by the regional board for each existing and proposed discharge after receipt of a report prepared in accordance with the implementation section of this plan.

2. The cumulative effects of elevated temperature waste discharges shall not cause temperatures to be increased except as provided in specific water quality objectives contained herein.

3. Areas of special biological significance shall be designated by the State Board after public hearing by the regional board and review of its recommendations.

4. An exception to the specific water quality objectives of this plan may be authorized by a regional board for a specific discharge upon a finding following public hearing that:

   A. An elevated temperature waste discharge in compliance with modified objectives will result in the enhancement of beneficial uses as compared to predischarge conditions, or

B. The use of heat on an intermittent basis to control fouling organisms in intake and discharge structures will result in less potential for deleterious effects upon beneficial uses than other alternative methods (heat, in addition to that required for cleaning of intake and discharge structures, shall not be used for cleaning of condenser units), or

C. Changes in existing discharge structures or their operation to obtain compliance with water quality objectives would result in an environmental impact greater than would occur with modified water quality objectives, or

D. Compliance by existing dischargers with specific water quality objectives would require modification of operations or facilities not commensurate with benefit to the aquatic environment.

Such authorization shall be effective only upon concurrence by the State Board and the Environmental Protection Agency.

5. Natural water temperature will be compared with waste discharge temperature by near-simultaneous measurements accurate to within $1^{o}F$. In lieu of near-simultaneous measurements, measurements may be made under calculated conditions of constant waste discharge and receiving water characteristics.

IMPLEMENTATION

1. The State Water Resources Control Board and the California Regional Water Quality Control Boards will administer this plan by establishing waste discharge requirements for discharges of elevated temperature wastes.

2. This plan is effective as of the date of adoption by the State Water Resources Control Board and the sections pertaining to temperature control in each of the policies and plans for the individual interstate and coastal waters shall be void and superseded by all applicable provisions of this plan.

3. Existing and future dischargers of thermal waste shall conduct a study to define the effect of the discharge on beneficial uses and, for existing discharges, determine design and operating changes which would be necessary to achieve compliance with the provisions of this plan.

4. Waste discharge requirements for existing elevated temperature wastes shall be reviewed to determine the need for studies of the effect of the discharge on beneficial uses, changes in monitoring programs and revision of waste discharge requirements.

5. Completed studies for existing discharges shall be submitted to the appropriate regional board prior to July 1973. The regional board shall review all studies and make necessary revisions to waste discharge requirements prior to January 1974 to assure compliance with all applicable provisions of this plan.

   Revised waste discharge requirements shall include a time schedule which assures compliance at the earliest possible date but not later than January 1976.

6. Completed studies for existing discharges of thermal wastes, existing waste discharge requirements, and proposed revised waste discharge requirements will be submitted by the State Board to EPA for review and comment prior to September 1973 and prior to adoption of revised waste discharge requirements.

7. Proposed dischargers of elevated temperature wastes may be required by the regional board to submit such studies prior to the establishment of waste discharge requirements. The regional board shall include in its requirements appropriate postdischarge studies by the discharger.

8. The scope of any necessary studies shall be as outlined by the regional board and shall be designed to include the following as applicable to an individual discharge:

   A. Existing conditions in the aquatic environment.

   B. Effects of the existing discharge on beneficial uses.

   C. Predicted conditions in the aquatic environment with waste discharge facilities designed and operated in compliance with the provisions of this plan.

   D. Predicted effects of the proposed discharge on beneficial uses.

   E. An analysis of costs and benefits of various design alternatives.

   F. The extent to which intake and outfall structures are located and designed so that the intake of planktonic organisms is at a minimum, waste plumes are prevented from touching the ocean substrate or shorelines, and the waste is dispersed into an area of pronounced along-shore or offshore currents.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 74- 57

AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE CONTROL OF TEMPERATURE IN THE COASTAL AND INTERSTATE WATERS AND ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA (THERMAL PLAN) AND THE WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA (OCEAN PLAN)

WHEREAS:

1. Carmel Bay is listed as an enclosed bay in paragraph 6 "Definition of Terms" of the Thermal Plan and is included in the listing of enclosed bays in footnote 2, page 10 of the Ocean Plan.

2. The Thermal Plan and Ocean Plan define enclosed bays as bays where the narrowest distance between headlands or the outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay.

3. The headlands enclosing Carmel Bay are identified in the Pacific Coast Pilot (U. S. Coast and Geodetic Survey) as Carmel Point and Cypress Point and using these reference points the width of Carmel Bay at its mouth is 84 percent of its greatest internal dimension.

4. The State Board held a hearing on July 18, 1974 for the purpose of receiving public comment on proposed amendments to delete Carmel Bay from the listings of enclosed bays in the Thermal Plan and Ocean Plan.

THEREFORE BE IT RESOLVED,

1. That the State Board amends the Thermal Plan by deleting Carmel Bay from the listing of enclosed bays in paragraph 6 entitled "Definition of Terms".

2. That the State Board amends the Ocean Plan by deleting Carmel Bay from the listing of enclosed bays in footnote 2, page 10.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on JUL 18 1974

Bill B. Dendy

Bill B. Dendy
Executive Officer

IV.

State of California
The Resources Agency

STATE WATER RESOURCES CONTROL BOARD

WATER QUALITY CONTROL POLICY
FOR THE
ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA

MAY 1974

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* To be furnished upon request.

WATER QUALITY CONTROL POLICY FOR THE ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA[1/]

INTRODUCTION

The purpose of this policy is to provide water quality principles and guidelines to prevent water quality degradation and to protect the beneficial uses of waters of enclosed bays and estuaries. Decisions on water quality control plans, waste discharge requirements, construction grant projects, water rights permits, and other specific water quality control implementing actions of the State and Regional Boards shall be consistent with the provisions of this policy.

The Board declares its intent to determine from time to time the need for revising this policy.

This policy does not apply to wastes from vessels or land runoff except as specifically indicated for siltation (Chapter III 4.) and combined sewer flows (Chapter III 7.).

CHAPTER I.

PRINCIPLES FOR MANAGEMENT OF WATER QUALITY IN ENCLOSED BAYS AND ESTUARIES

A. It is the policy of the State Board that the discharge of municipal wastewaters and industrial process waters[2/] (exclusive of cooling water discharges) to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, shall be phased out at the earliest practicable date. Exceptions to this provision may be granted by a Regional Board only when the Regional Board finds that the wastewater in question would consistently be treated and discharged in such a manner that it would enhance the quality of receiving waters above that which would occur in the absence of the discharge.[3/]

B. With regard to the waters of the San Francisco Bay-Delta system, the State Board finds and directs as follows:

1a. There is a considerable body of scientific evidence and opinion which suggests the existence of biological degradation due to long-term exposure to toxicants which have been discharged to the San Francisco Bay-Delta system. Therefore, implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded wastewater treatment, and improved dilution of wastewaters, shall proceed as rapidly as is practicable with the objective of providing full protection to the biota and the beneficial uses of Bay-Delta waters in a cost-effective manner.

1b. A comprehensive understanding of the biological effects of wastewater discharge on San Francisco Bay, as a whole, must await the results of further scientific study. There is, however, sufficient evidence at this time to indicate that the continuation of wastewater discharges to the southern reach of San Francisco Bay, south of the Dumbarton Bridge, is an unacceptable condition. The State Board and the San Francisco Regional Board shall take such action as is necessary to assure the elimination of wastewater discharges to waters of the San Francisco Bay, south of Dumbarton Bridge, at the earliest practicable date.

1c. In order to prevent excessive investment which would unduly impact the limited funds available to California for construction of publicly owned treatment works, construction of such works shall proceed in a staged fashion, and each stage shall be fully evaluated by the State and Regional Boards to determine the necessity for additional expenditures. Monitoring requirements shall be established to evaluate any effects on water quality, particularly changes in species diversity and abundance, which may result from the operation of each stage of planned facilities and source control programs. Such a staged construction program, in combination with an increased monitoring effort, will result in the most cost-effective and rapid progress toward a goal of maintaining and enhancing water quality in the San Francisco Bay-Delta system.

2. Where a waste discharger has an alternative of in-bay or ocean disposal and where both alternatives offer a similar degree of environmental and public health protection, prime consideration shall be given to the alternative which offers the greater degree of flexibility for the implementation of economically feasible wastewater reclamation options.

C. The following policies apply to all of California's enclosed bays and estuaries:

1. Persistent or cumulative toxic substances shall be removed from the waste to the maximum extent practicable through source control or adequate treatment prior to discharge.
2. Bay or estuarine outfall and diffuser systems shall be designed to achieve the most rapid initial dilution[4/] practicable to minimize concentrations of substances not removed by source control or treatment.
3. Wastes shall not be discharged into or adjacent to areas where the protection of beneficial uses requires spatial separation from waste fields.
4. Waste discharges shall not cause a blockage of zones of passage required for the migration of anadromous fish.
5. Nonpoint sources of pollutants shall be controlled to the maximum practicable extent.

CHAPTER II.

QUALITY REQUIREMENTS FOR WASTE DISCHARGES

1. In addition to any requirements of this policy, effluent limitations shall be as specified pursuant to Chapter 5.5 of the Porter-Cologne Water Quality Control Act, and Regional Boards shall limit the mass emissions of substances as necessary to meet such limitations. Regional Boards may set more restrictive mass emission rates and concentration standards than those which are referenced in this policy to reflect dissimilar tolerances to wastewater constituents among different receiving water bodies.

2. All dischargers of thermal wastes or elevated temperature wastes to enclosed bays and estuaries which are permitted pursuant to this policy shall comply with the "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of Califonia", State Water Resources Control Board, 1972, and with amendments and supplements thereto.

3. Radiological limits for waste discharges (for which regulatory responsibility is not preempted by the Federal Government) shall be at least as restrictive as limitations indicated in Section 30269, and Section 30355, Appendix A, Table II, of the California Administrative Code.

4. Dredge spoils to be disposed of in bay and estuarine waters must comply with federal criteria for determining the acceptability of dredged spoils to marine waters, and must be certified by the State Board or Regional Boards as in compliance with State Plans and Policies.

CHAPTER III.

DISCHARGE PROHIBITIONS

1. New discharges[5] of municipal wastewaters and industrial process waters[2] (exclusive of cooling water discharges) to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, which are not consistently treated and discharged in a manner that would enhance the quality of receiving waters above that which would occur in the absence of the discharge, shall be prohibited.
2. The discharge of municipal and industrial waste sludge and untreated sludge digester supernatant, centrate, or filtrate to enclosed bays and estuaries shall be prohibited.
3. The deposition of rubbish or refuse into surface waters or at any place where they would be eventually transported to enclosed bays or estuaries shall be prohibited.[6]
4. The direct or indirect discharge of silt, sand, soil clay, or other earthen materials from onshore operations including mining, construction, agriculture, and lumbering, in quantities which unreasonably affect or threaten to affect beneficial uses shall be prohibited.
5. The discharge of materials of petroleum origin in sufficient quantities to be visible or in violation of waste discharge requirements shall be prohibited, except when such discharges are conducted for scientific purposes. Such testing must be approved by the Executive Officer of the Regional Board and the Department of Fish and Game.
6. The discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste shall be prohibited.
7. The discharge or by-passing of untreated waste to bays and estuaries shall be prohibited.[7]

CHAPTER IV.

GENERAL PROVISIONS

A. Effective Date

This policy is in effect as of the date of adoption by the State Water Resources Control Board.

B. Review and Revision of Plans, Policies and Waste Discharge Requirements

Provisions of existing or proposed policies or water quality control plans adopted by the State or Regional Boards for enclosed bays or estuaries shall be amended to conform with the applicable provisions of this policy.

Each appropriate Regional Board shall review and revise the waste discharge requirements with appropriate time schedules for existing discharges to achieve compliance with this policy and applicable water quality objectives. Each Regional Board affected by this policy shall set forth for each discharge allowable mass emission rates for each applicable effluent characteristic included in waste discharge requirements.

Regional Boards shall finalize waste discharge requirements as rapidly as is consistent with the National Pollutant Discharge Elimination System Permit Program.

C. <u>Administration of Clean Water Grants Program</u>

The Clean Water Grants Program shall require that the environmental impact report for any existing or proposed wastewater discharge to enclosed bays and estuaries, other than the San Francisco Bay-Delta system, shall evaluate whether or not the discharge would enhance the quality of receiving waters above that which would occur in the absence of the discharge.

The Clean Water Grants Program shall require that each study plan and project report (beginning with F. Y. 1974-75 projects) for a proposed wastewater treatment or conveyance facility within the San Francisco Bay-Delta system shall contain an evaluation of the degree to which the proposed project represents a necessary and cost-effective stage in a program leading to compliance with an objective of full protection of the biota and beneficial uses of Bay-Delta waters.

D. <u>Administration of Water Rights</u>

Any applicant for a permit to appropriate from a watercourse which is tributary to an enclosed bay or estuary may be required to present to the State Board an analysis of the anticipated effects of the proposed appropriation on water quality and beneficial uses of the effected bay or estuary.

E. Monitoring Program

The Regional Board shall require dischargers to conduct self-monitoring programs and submit reports as necessary to determine compliance with waste discharge requirements and to evaluate the effectiveness of wastewater control programs. Such monitoring programs shall comply with applicable sections of the State Board's Administrative Procedures, and any additional guidelines which may be issued by the Executive Officer of the State Board.

FOOTNOTES

1/ Enclosed bays are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outer most harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes, but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

Estuaries, including coastal lagoons, are waters at the mouths of streams which serve as mixing zones for fresh and ocean waters. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters shall be considered to extend seaward if significant mixing of fresh and saltwater occurs in the open coastal waters. Estuarine waters include, but are not limited to, the Sacramento-San Joaquin Delta, as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

2/ For the purpose of this policy, treated ballast waters and innocuous nonmunicipal wastewater such as clear brines, wash-water, and pool drains are not necessarily considered industrial process wastes, and may be allowed by Regional Boards under discharge requirements that provide protection to the beneficial uses of the receiving water.

3/ Undiluted wastewaters covered under this exception provision shall not produce less than 90 percent survival, 50 percent of the time, and not less than 70 percent survival, 10 percent of the time of a standard test species in a 96-hour static or continuous flow bioassay test using undiluted waste. Maintenance of these levels of survival shall not by themselves constitute sufficient evidence that the discharge satisfies the criteria of enhancing the quality of the receiving water above that which occur in the absence of the discharge. Full and uninterrupted protection for the beneficial uses of the receiving water must be maintained. A Regional Board may require physical, chemical, bioassay, and bacteriological assessment of treated wastewater quality prior to authorizing release to the bay or estuary of concern.

4/ Initial dilution zone is defined as the volume of water near the point of discharge within which the waste immediately mixes with the bay or estuarine water due to the momentum of the waste discharge and the difference in density between the waste and receiving water.

5/ A new discharge is a discharge for which a Regional Board has not received a report of waste discharge prior to the date of adoption of this policy, and which was not in existence prior to the date of adoption of this policy.

6/ Rubbish and refuse include any cans, bottles, paper, plastic, vegetable matter, or dead animals or dead fish deposited or caused to be deposited by man.

7/ The prohibition does not apply to cooling water streams which comply with the "Water Quality Control Plan for the Control of Temperature in Coastal and Interstate Waters and Enclosed Bays and Estuaries of California" - State Water Resources Control Board.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 74- 43

WATER QUALITY CONTROL POLICY FOR THE ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA

WHEREAS:

1. The Board finds it necessary to promulgate water quality principles, guidelines, effluent quality requirements, and prohibitions to govern the disposal of waste into the enclosed bays and estuaries of California;

2. The Board, after review and analysis of testimony received at public hearings, has determined that it is both feasible and desirable to require that the discharge of municipal wastewaters and industrial process waters to enclosed bays and estuaries (other than the San Francisco Bay-Delta system) should only be allowed when a discharge enhances the quality of the receiving water above that which would occur in the absence of the discharge;

3. The Board has previously promulgated requirements for the discharge of thermal and elevated temperature wastes to enclosed bays and estuaries (Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California - SWRCB, 1972);

4. The Board, after review and analysis of testimony received at public hearings, has determined that implementation of a program which controls toxic effects through a combination of source control for toxic materials, upgraded waste treatment, and improved dilution of wastewaters, will result in timely and cost-effective progress toward an objective of providing full protection to the biota and beneficial uses of San Francisco Bay-Delta waters;

5. The Board intends to implement monitoring programs to determine the effects of source control programs, upgraded treatment, and improved dispersion of wastewaters on the condition of the biota and beneficial uses of San Francisco Bay-Delta waters.

THEREFORE, BE IT RESOLVED, that

1. The Board hereby adopts the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California".

2. The Board hereby directs all affected California Regional Water Quality Control Boards to implement the provisions of the policy.

3. The Board hereby declares its intent to determine from time to time the need for revising the policy to assure that it reflects current knowledge of water quality objectives necessary to protect beneficial uses of bay and estuarine waters and that it is based on latest technological improvements.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 16, 1974.

Bill B. Dendy

Bill B. Dendy
Executive Officer

V.

State of California
The Resources Agency

STATE WATER RESOURCES CONTROL BOARD

WATER QUALITY CONTROL PLAN
FOR
OCEAN WATERS OF CALIFORNIA

Adopted and Effective

July 6, 1972

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RESOLUTION NO. 72-45

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 72-45

WATER QUALITY CONTROL PLAN
FOR
OCEAN WATERS OF CALIFORNIA

WHEREAS:

1. The Board finds it necessary to promulgate water quality objectives and effluent quality requirements to govern the disposal of waste into the coastal waters of California;

2. The Board, after extensive review and analysis of testimony received at public hearings, has determined that protection of beneficial uses of the ocean waters of the State will require maximum practicable control of waste substances which may unreasonably impair those uses;

3. The Board finds that maximum practicable control of waste can be achieved through a comprehensive program which combines source control of waste and modern waste treatment technology;

4. The Board believes that application of current technology through intelligent design of control systems rather than irrational specification of arbitrary treatment methods can provide the highest degree of water quality protection without unreasonable cost;

5. The Board intends to implement monitoring programs to determine compliance with water quality objectives and effluent quality requirements, and to yield other information such as the effectiveness of source control programs and the identification of any short-term or long-term degradation of marine biota;

6. The Board intends to review all available data from time to time to determine the efficacy of control programs for protecting water quality;

THEREFORE, BE IT RESOLVED, that

1. The Board hereby adopts the "WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA"

2. The Board hereby directs all affected California Regional Water Quality Control Boards to implement the provisions of the PLAN.

3. The Board hereby directs its Executive Officer to issue guidelines for monitoring the effects of waste discharges to the ocean at the earliest possible date.

4. The Board hereby declares its intent to determine from time to time the need for revising the PLAN to assure that it reflects current knowledge of water quality objectives necessary to protect beneficial uses of ocean waters and that it is based on latest technological improvements.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on July 6, 1972.

Bill B. Dendy

Bill B. Dendy
Executive Officer

2. At all areas[4/] where shellfish may be harvested for human consumption, the following bacteriological objectives shall be maintained throughout the water column:

   The median total coliform concentration shall not exceed 70 per 100 ml, and not more than 10 percent of the samples shall exceed 230 per 100 ml.

B. Physical Characteristics

1. Floating particulates and grease and oil shall not be visible.

2. The concentration of grease and oil (hexane extractables) on the water surface shall not exceed 10 mg/m^2 more than 50 percent of the time, nor 20 mg/m^2 more than 10 percent of the time.[5/]

3. The concentration of floating particulates of waste origin on the water surface shall not exceed 1.0 mg dry weight/m^2 more than 50 percent of the time, nor 1.5 mg dry weight/m^2 more than 10 percent of the time.[5/]

4. The discharge of waste shall not cause esthetically undesirable discoloration of the ocean surface.

5. The transmittance of natural light shall not be significantly[6/] reduced at any point outside the initial dilution zone.[7/]

6. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.[8/]

C. Chemical Characteristics

1. The dissolved oxygen concentration[9/] shall not at any time be depressed more than 10 percent from that which occurs naturally.

2. The pH[9/] shall not be changed at any time more than 0.2 units from that which occurs naturally.

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA

All Regions

In furtherance of legislative policy set forth in Section 13000 of Division 7 of the California Water Code (Stats. 1969, Chap. 482) and pursuant to the authority contained in Section 13170 (Stats. 1971, Chap. 1288) the State Water Resources Control Board hereby finds and declares that protection of the quality of the ocean waters for use and enjoyment by the people of the State requires control of the discharge of waste[1] to ocean waters[2] in accordance with the provisions contained herein.

CHAPTER I. BENEFICIAL USES

The beneficial uses of the ocean waters of the State that shall be protected include industrial water supply, recreation, esthetic enjoyment, navigation, and preservation and enhancement of fish, wildlife, and other marine resources or preserves.

CHAPTER II. WATER QUALITY OBJECTIVES

This chapter sets forth limits or levels of water quality characteristics for ocean waters to ensure the reasonable protection of beneficial uses and the prevention of nuisance. The discharge of waste shall not cause violation of these objectives.[3]

A. Bacteriological Characteristics

1. Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas[4] outside this zone used for body-contact sports, the following bacteriological objectives shall be maintained throughout the water column:

   (a.) Samples of water from each sampling station shall have a ~~most probable number~~ concentration of coliform organisms less than 1,000 per 100 ml (10 per ml); provided that not more than 20 percent of the samples at any sampling station, in any 30-day period, may exceed 1,000 per 100 ml (10 per ml), and provided further that no single sample when verified by a repeat sample taken within 48 hours shall exceed 10,000 per 100 ml (100 per ml).

   (b.) The fecal coliform concentration based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 per 100 ml nor shall more than 10 percent of the total samples during any 30-day period exceed 400 per 100 ml.

Adopted by the State Water Resources Control Board by Resolution No. 72-45 on July 6, 1972.

3. The dissolved sulfide concentration of waters in and near sediments shall not be significantly[6] increased above that present under natural conditions.

4. The concentration of substances set forth in Chapter IV, Table B, in marine sediments shall not be significantly[6] increased above that present under natural conditions.

5. The concentration of organic materials in marine sediments shall not be increased above that which would degrade[8] marine life.

6. Nutrient materials shall not cause objectionable aquatic growths or degrade[8] indigenous biota.

D. Biological Characteristics

1. Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded.[8]

2. The natural taste, odor, and color of fish, shellfish, or other marine resources used for human consumption shall not be altered.

E. Toxicity Characteristics

1. The final toxicity concentration shall not exceed 0.05 toxicity units.[10]

F. Radioactivity

1. Radioactivity shall not exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 3, Section 30269 of the California Administrative Code.

CHAPTER III. PRINCIPLES FOR MANAGEMENT OF WASTE DISCHARGES TO THE OCEAN

A. Waste management systems that discharge to the ocean must be designed and operated in a manner that will maintain the indigenous marine life and a healthy and diverse marine community.

B. Waste discharged to the ocean must be essentially free[11/] of:

1. material that is floatable or will become floatable upon discharge,

2. settleable material or substances that form sediments which degrade[8/] benthic communities or other aquatic life,

3. substances toxic to marine life due to increases in concentrations in marine waters or sediments,

4. substances that significantly decrease the natural light to benthic communities and other marine life, and

5. materials that result in esthetically undesirable discoloration of the ocean surface.

C. Ocean outfalls and diffusion systems must be designed to achieve rapid initial dilution[12/] and effective dispersion to minimize concentrations of substances not removed by treatment.

D. Location of waste discharges must be determined after a detailed assessment of the oceanographic characteristics and current patterns to assure that:

1. pathogenic organisms and viruses are not present in areas where shellfish are harvested for human consumption or in areas used for swimming or other body-contact sports,[13/]

2. natural water quality conditions are not altered in areas designated as being of special biological significance, and

3. maximum protection is provided to the marine environment.

CHAPTER IV.
QUALITY REQUIREMENTS FOR WASTE DISCHARGES (EFFLUENT QUALITY REQUIREMENTS)

This chapter sets forth the quality requirements for waste discharges to the ocean.3/

TABLE A

		Concentration not to be exceeded more than:	
	Unit of measurement	50% of time	10% of time
Grease and Oil (hexane extractables)	mg/l	10.	15.
Floating Particulates (dry weight)	mg/l	1.0	2.0
Suspended Solids	mg/l	50.	75.
Settleable Solids	ml/l	0.1	0.2
Turbidity	JTU	50.	75.
pH	units	within limits of 6.0 to 9.0 at all times.	

TABLE B

	Unit of measurement	Concentration not to be exceeded more than: 50% of time	10% of time
Arsenic	mg/l	0.01	0.02
Cadmium	mg/l	0.02	0.03
Total Chromium	mg/l	0.005	0.01
Copper	mg/l	0.2	0.3
Lead	mg/l	0.1	0.2
Mercury	mg/l	0.001	0.002
Nickel	mg/l	0.1	0.2
Silver	mg/l	0.02	0.04
Zinc	mg/l	0.3	0.5
Cyanide	mg/l	0.1	0.2
Phenolic Compounds	mg/l	0.5	1.0
Total Chlorine Residual	mg/l	1.0	2.0
Ammonia (expressed as nitrogen)	mg/l	40.	60.
Total Identifiable Chlorinated Hydrocarbons 14/	mg/l	0.002	0.004
Toxicity Concentration 10/	tu	1.5	2.0
Radioactivity		not to exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 5, Section 30285 and 30287 of the California Administrative Code.	

CHAPTER V.
DISCHARGE PROHIBITIONS

A. Hazardous Substances

The discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste into the ocean is prohibited.

B. Areas of Special Biological Significance

Waste shall be discharged a sufficient distance from areas designated as being of special biological significance to assure maintenance of natural water quality conditions in these areas.

C. Sludge

The discharge of municipal and industrial waste sludge and sludge digester supernatant directly to the ocean, or into a waste stream that discharges to the ocean without further treatment, shall be prohibited.

D. By-Passing

The by-passing of untreated waste to the ocean shall be prohibited.

CHAPTER VI.
GENERAL PROVISIONS

A. Effective Date

This plan is in effect as of the date of adoption by the State Water Resources Control Board. The less restrictive provisions of each of the extant policies and plans for the ocean shall be void and superseded by all applicable provisions of this plan.

B. Mass Emission Rates

In addition to receiving water objectives and effluent quality requirements, waste discharge requirements shall set forth the Maximum Allowable Daily Mass Emission Rate and the Maximum Allowable Monthly Mass Emission Rate for each effluent quality constituent included in the waste discharge requirements.

The Maximum Allowable Daily Mass Emission Rate for each constituent shall be calculated from the total waste flow occurring each specific day and the concentration specified in waste discharge requirements as that not to be exceeded more than 10 percent of the time. The mass emission rate of the discharge during any 24-hour period shall not exceed the Maximum Allowable Daily Mass Emission Rate.

The Maximum Allowable Monthly Mass Emission Rate for each constituent shall be calculated from the total waste flow occurring in each specific month and the concentration specified in waste discharge requirements as that not to be exceeded more than 50 percent of the time. The mass emission rate of the discharge during any monthly period shall not exceed the Maximum Allowable Monthly Mass Emission Rate.

C. Technical Reports

Persons responsible for existing waste discharges to the ocean shall be required by the Regional Board to submit a technical report prior to January 15, 1973. The technical report shall include but not be limited to:

1. A proposed program of improvement of waste treatment facilities necessary to assure compliance with all provisions of this plan.

2. A proposed time schedule for construction of necessary facilities.

3. An estimate of the capital cost of necessary facilities.

4. Any request, with supporting evidence, for less restrictive effluent quality requirements.

5. An analysis of all other factors deemed necessary by the Regional Board to permit establishment of waste discharge requirements.

For discharges exceeding 40 mgd the technical report shall include a correlation of the effluent quality requirements for the parameters set forth in Chapter IV, Table A, with all water quality objectives set forth in Chapter II, and with all effluent quality requirements set forth in Chapter IV, Table B.

D. Waste Discharge Requirements

The Regional Boards may establish more restrictive water quality objectives and effluent quality requirements than those set forth in this plan as necessary for the protection of beneficial uses of the ocean.

Effluent quality requirements shall not be less restrictive than those set forth in Chapter IV, Table B, of this plan.

Effluent quality requirements may be less restrictive than those set forth in Chapter IV, Table A, of this plan provided the Regional Board finds that the discharge shall comply with all water quality objectives set forth in Chapter II and all effluent quality requirements set forth in Chapter IV, Table B. Less restrictive effluent quality requirements shall be effective only upon approval by the State Board.

E. Revision of Waste Discharge Requirements

The Regional Board shall revise the waste discharge requirements for existing discharges as necessary to achieve compliance with this plan and shall also establish a time schedule for compliance. Prior to adoption, but not later than April 15, 1973, the Regional Board shall submit to the State Board all technical reports provided by the waste dischargers, proposed waste discharge requirements, and time schedules for compliance for all discharges to the ocean.

F. State Board Review of Time Schedules

The State Board shall review proposed time schedules for all municipal discharges throughout the State and shall recommend to the Regional Boards specific schedules to assure the maximum benefit from, and equitable distribution of, available state and federal grant funds.

G. Monitoring Program

The Regional Board shall require dischargers to conduct self-monitoring programs and submit reports necessary to determine compliance with the waste discharge requirements, and may require dischargers to contract with agencies or persons acceptable to the Regional Board to provide monitoring reports. Such monitoring programs shall comply with Guidelines for Monitoring the Effects of Waste Discharges on the Ocean which shall be issued by the Executive Officer of the State Board.

H. Areas of Special Biological Significance

Areas of special biological significance shall be designated by the State Board after a public hearing by the Regional Board and review of its recommendations.

FOOTNOTES

1/ This plan is not applicable to vessel wastes, the control of dredging, or the disposal of dredging spoil. Provisions regulating the thermal aspects of waste discharged to the ocean are set forth in the Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California dated May 18, 1972.

2/ Ocean waters are waters of the Pacific Ocean adjacent to the California coast outside of enclosed bays, estuaries, and coastal lagoons.

Enclosed bays are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Carmel Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

Estuaries and coastal lagoons are waters at the mouths of streams which serve as mixing zones for fresh and ocean waters during a major portion of the year. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

Footnotes

3/ The Water Quality Objectives and Effluent Quality Requirements are defined by a statistical distribution when appropriate. This method recognizes the normally occurring variations in treatment efficiency and sampling and analytical techniques and does not condone poor operating practices. The 50 percentile value (concentration not to be exceeded more than 50 percent of the time) and 90 percentile value (concentration not to be exceeded more than 10 percent of the time) establish an acceptable distribution for any consecutive 30-day period. The distribution of actual sampling data for any consecutive 30-day period shall not have any percentile value exceeding that of the acceptable distribution.

4/ Body-contact sports areas outside the shoreline zone set forth in Chapter II. A.1. and all shellfishing areas shall be determined by the Regional Board on an individual basis.

5/ Surface samples shall be collected from stations representative of the area of maximum probable impact.

6/ The mean of sampling results for any consecutive 30-day period must be within one (1) standard deviation of the mean determined for natural levels for the same period.

7/ Initial Dilution Zone is the volume of water near the point of discharge within which the waste immediately mixes with ocean water due to the momentum of the waste discharge and the difference in density between the waste and the receiving water.

8/ Degradation shall be determined by analysis of the effects of waste discharge on species diversity, population density, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species.

9/ Compliance with water quality objectives shall be determined from samples collected at stations representative of the area within the waste field where initial dilution is completed. The 10 percent depression of dissolved oxygen may be determined after allowance for effects of induced upwelling.

10/ This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

a. Toxicity Concentration (Tc)

Expressed in Toxicity Units (tu)

$$Tc\ (tu) = \frac{100}{96\text{-hr. TLm\%}}$$

b. Median Tolerance Limit (TLm%)

The TLm shall be determined by static or continuous flow bioassay techniques using standard test species. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, the TLm may be determined after the test samples are adjusted to remove the influence of those substances.

When it is not possible to measure the 96-hr. TLm due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

$$Tc\ (tu) = \frac{\log\ (100 - S)}{1.7}$$

S = percentage survival in 100% waste.

c. Toxicity Emission Rate (TER)

Is the product of the effluent Toxicity Concentration (Tc) and the waste flow rate expressed as mgd.

$$TER\ (tu \cdot mgd) = Tc\ (tu) \times \text{Waste Flow Rate (mgd)}$$

d. Final Toxicity Concentration

(FTc) expressed in toxicity units (tu) shall be determined by a bioassay and estimated by the following calculations:

$$FTc\ (tu) = \frac{\text{Toxicity Emission Rate}}{\text{Initial Dilution Water + Waste Flow}}$$

$$= \frac{TER}{Qd + Qw}$$

e. Initial Dilution Water (Qd)

Shall be calculated as the product of estimated current velocity, effective diffuser length normal to the prevailing current, and effective mixing depth.

11/ Essentially free means the specific limitations set forth in Chapter IV of this plan.

12/ Diffusion systems should provide an initial dilution of wastewater with seawater exceeding 100 to 1 at least 50 percent of the time, and exceeding 80 to 1 at least 90 percent of the time. If a waste is essentially identical to natural seawater, less restrictive dilution requirements may be permitted by the Regional Board.

13/ Waste that contains pathogenic organisms or viruses should be discharged a sufficient distance from shellfishing and body-contact sports areas to maintain applicable bacteriological standards without disinfection. Where conditions are such that an adequate distance cannot be attained, reliable disinfection in conjunction with a reasonable separation of the discharge point from the area of use must be provided. Consideration should be given to disinfection procedures that do not increase effluent toxicity and that constitute the least environmental and human hazard in their production, transport, and utilization.

14/ Total Identifiable Chlorinated Hydrocarbons shall be measured by summing the individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 74- 57

AMENDMENTS TO THE WATER QUALITY CONTROL PLAN FOR THE CONTROL OF TEMPERATURE IN THE COASTAL AND INTERSTATE WATERS AND ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA (THERMAL PLAN) AND THE WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA (OCEAN PLAN)

WHEREAS:

1. Carmel Bay is listed as an enclosed bay in paragraph 6 "Definition of Terms" of the Thermal Plan and is included in the listing of enclosed bays in footnote 2, page 10 of the Ocean Plan.

2. The Thermal Plan and Ocean Plan define enclosed bays as bays where the narrowest distance between headlands or the outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay.

3. The headlands enclosing Carmel Bay are identified in the Pacific Coast Pilot (U. S. Coast and Geodetic Survey) as Carmel Point and Cypress Point and using these reference points the width of Carmel Bay at its mouth is 84 percent of its greatest internal dimension.

4. The State Board held a hearing on July 18, 1974 for the purpose of receiving public comment on proposed amendments to delete Carmel Bay from the listings of enclosed bays in the Thermal Plan and Ocean Plan.

THEREFORE BE IT RESOLVED,

1. That the State Board amends the Thermal Plan by deleting Carmel Bay from the listing of enclosed bays in paragraph 6 entitled "Definition of Terms".

2. That the State Board amends the Ocean Plan by deleting Carmel Bay from the listing of enclosed bays in footnote 2, page 10.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on JUL 18 1974

Bill B. Dendy

Bill B. Dendy
Executive Officer

STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

1416 Ninth Street, Sacramento, California 95814

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

NORTH COAST REGION (1)
1000 Coddingtown Center
Santa Rosa, California 95406
(707) 545–2620

SAN FRANCISCO BAY REGION (2)
1111 Jackson Street, Room 6040
Oakland, California 94607
(415) 464–1255

CENTRAL COAST REGION (3)
1122–A Laurel Lane
San Luis Obispo, California 93401
(805) 549–3147

LOS ANGELES REGION (4)
107 South Broadway, Room 4027
Los Angeles, California 90012
(213) 620–4460

CENTRAL VALLEY REGION (5)
3201 S Street
Sacramento, California 95816
(916) 445–0270

FRESNO BRANCH OFFICE
(Central Valley Region)
3374 Shields Avenue, (P.O. Box 2188)
Fresno, California 93719
(209) 488–5116

LAHONTAN REGION (6)
1014 Blue Lake Avenue, Suite 3
P.O. Box 14367
South Lake Tahoe, California 95702
(916) 544–3481

BISHOP BRANCH OFFICE
(Lahontan Region)
633 N. Main Street
Bishop, California 93514
(714) 873–7111

COLORADO RIVER BASIN REGION (7)
81–715 Highway 111 (P.O. Drawer 1)
Indio, California 92201
(714) 347–4011

SANTA ANA REGION (8)
6833 Indiana Avenue, Suite 1
Riverside, California 92506
(714) 684–9330

SAN DIEGO REGION (9)
6154 Mission Gorge Road, Suite 205
San Diego, California 92120
(714) 286–5114

Water Quality Control Plan Report

CENTRAL COASTAL BASIN (3)

STATE WATER RESOURCES CONTROL BOARD

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION (3)

WATER QUALITY CONTROL PLAN
CENTRAL COASTAL BASIN

PART II

April 1975

STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

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PART II. SUPPORTING INFORMATION

SECTION 1. THE PLANNING FRAMEWORK

Chapter 8 Public Participation

Public participation has, in recent years, become a major input in planning public facilities and policies. Planners may develop technically, financially and ecologically sound plans but it remains for the public to choose the most socially acceptable alternative. Full public participation results in maximum public support which aids in the implementation of the recommended plans. Sections 13147 and 13244 of the Porter-Cologne Water Quality Control Act require public hearings before the adoption of "...state policy for water quality control...", or "...water quality control plans...". Guidelines for scheduling and conducting public meetings were provided by the State Board on August 10, 1972. Briefly, these guidelines require the Regional Board to arrange the meetings, circulate meeting notices and conduct the meetings, all in coordination with the Basin Contractor and State Board.

PROGRAM ORGANIZATION

Four general subjects were discussed in the public forum at several locations throughout the Central Coastal Basin. The first set of hearings, early in the program, introduced the public to the planning process and study organization. Beneficial uses and water quality objectives were presented and discussed in the second hearings. Alternative plans for the different sub-basins were discussed in the third round of hearings and a fourth was held to present the recommended plans. A later section of this chapter lists the dates and locations of the public hearings. All meetings were given notice in local papers and some received radio and television announcements to encourage attendance. Graphical materials were designed to aid public understanding and to stimulate interest; announcements were also sent out well in advance of the meeting date and technical handout materials were generally available.

Subsequent to the distribution of the state's guidelines for public participation, Congress passed the Federal Water Pollution Control Act, Amendments of 1972, (PL 92-500). Section 101(e) specifies, "Public participation in the development, revision and enforcement of any regulation, standard, effluent limitation, plan or program established by the Administrator or any State under this Act shall be provided for, encouraged and assisted by the Administrator and the States."

Public Law 92-500 provides that regulations specifying minimum guidelines for public participation will be developed and published. These regulations have been published as Part 105, Public Participation in Water Quality Control, Subchapter D, Chapter 1 CFR Title 40, first promulgated on February 23, 1973, and later revised on August 23, 1973. These regulations set forth (1) Guidelines for Agency Programs, (2) Guidelines for Reporting, (3) Guidelines for Evaluation, and (4) Guidelines for Public Hearings, as a minimum program. These regulations apply to all EPA functions and to State and interstate agencies with water quality control functions.

The Guidelines for Public Hearings provide that public hearings be held to give persons and organizations a formal opportunity to be heard on a matter prior to decision-making. The final actions are to benefit from and reflect consideration of the record of the hearing. In addition to hearings, agencies are encouraged to hold more informal public meetings and workshops that are informational in nature and provide opportunity for public response. Hearings are to be well publicized in addition to complying with the legal requirements of notice. Time and location of meetings are to be determined with consideration of meeting accessibility and easing travel hardship. Pertinent reports, documents and data shall be made available to the public for a reasonable time prior to the hearing. Public hearing procedures are not to inhibit free expression of views or require qualification of the speaker beyond that needed for identification. Records of the hearing are to be made promptly available to the public at cost.

The federal guidelines specify that for statewide or areawide programs, or portions thereof, requiring approval by the Administrator, a summary of public participation be submitted as part of the plan or of the public transmittal document. This plan falls in the category requiring Administrator approval and, therefore, a summary of the public participation has been prepared as the portion of this chapter which follows.

Although the federal guidelines were promulgated after the first two series of meetings were held, the procedures and extent of public participation employed for these meetings followed the intent, if not the letter, of the regulations. Meetings held subsequent to the appearance of the regulations have been conducted in accordance therewith. Particular emphasis has been placed upon coordination with local agencies and organizations in arranging these meetings and in publicizing their occurrence.

In general, the tenor of the public meetings has been kept at a low level of formality to encourage maximum participation by individuals. Many of the meetings have been described, in the notices, as workshops to convey the impression of an informal meeting. The Regional Board staff has contributed materially to the informality and familiarity in these meetings because these people are well known to the water-interested public.

ROLE OF REGIONAL BOARDS

The Central Coastal Regional Water Quality Control Board has played a major role in assisting in the development of this plan. Coordination with the dischargers and the public was provided as well as review of many of the task reports and the unabridged reports. Arrangements for public meetings were made by the Regional Board staff who also mailed meeting notices and arranged for newspaper, radio and television announcements of these meetings. Information contained in the Board's files was provided on numerous occasions and the Regional Board served as an information depository of planning documents for public inspection.

PROCEDURES FOR PUBLIC INPUT

Early in the planning process the value of public participation was recognized as a necessary ingredient in developing and implementing realistic, viable plans. Thus public participation was actively solicited and seriously considered. In addition to the public input described below and in Appendix C, a Technical Advisory Committee was established in the AMBAG area. This Committee was comprised primarily of public works officials from AMBAG member agencies and they met once a month to review progress and make recommendations with respect to the conduct of the AMBAG study. Special briefings were conducted at Regional Board meetings to inform the Board of the basin Contractor's direction and results. Recommended plans were presented to the Board with a briefing document on December 13, 1973.

Asterisks in the following list indicate the meetings for which briefing documents were prepared by the Basin Contractor. These documents were written, as much as possible, for the general public without a sacrifice of key technical material.

I	Introductory Meeting	
	Santa Barbara	June 29, 1972
	San Luis Obispo	June 30, 1972
II	Water Quality Objectives and Beneficial Uses	
	Santa Maria	September 7, 1972
III	Alternative Plans	
	Santa Cruz	November 30, 1972
	King City	December 1, 1972
	Gilroy	December 7, 1972
	Pacific Grove	December 7, 1972
	*San Luis Obispo	January 18, 1973
	*Lompoc	March 15, 1973
	*Santa Maria	April 10, 1973
	*Santa Barbara	June 25, 1973
IV	Recommended Plans	
	Salinas	February 8, 1973
	Santa Cruz	April 26, 1973
	*Santa Barbara	August 13, 1973
	*Santa Maria	August 14, 1973
	*San Luis Obispo	August 14, 1973
	*Monterey	December 13, 1973

* Indicates a briefing document was prepared.

Two additional meetings concerning recommended plans were conducted in the southern portion of the Basin. Santa Barbara County municipal dischargers met with the basin contractor in Goleta on August 23, 1973 and a similar meeting was held with the San Luis Obispo County dischargers on August 24, 1973. These small, informal meetings were held to insure maximum input by those most affected by the recommended plans.

Early in the planning process (December 6, 1972), members from the agricultural community were informed of the activity plan as it relates to agriculture. Recommended plans for agricultural practices were discussed with members of the agricultural community on July 16, 1973, in the San Luis Obispo County agricultural advisor's office.

Public attendance was light in some meetings, well attended and productive in others. Recorded attendance ranged from six in King City to 85 in Santa Cruz. The response and comments offered are briefly touched upon in the next section and given greater consideration in Appendix C.

PUBLIC MEETING RESULTS

Overall, public reaction was variable, ranging from apathetic to strong support as well as vocal opposition.

In the AMBAG area, the greatest interest in alternatives and plans revolved about the Santa Cruz and South Monterey Bay areas. Wastewater reclamation is recommended for early implementation in the South Monterey Bay area, and it is identified as a possibility in the Santa Cruz area. In the South Monterey Bay area, the recommended plan was not questioned as to economic feasibility; but there were questions as to whether the plan could be implemented. The lack of a firm market for the reclaimed water to offset incremental costs of going from secondary treatment and Bay disposal to advanced treatment and reuse for agricultural purposes around Castroville caused the development of a staged plan involving disposal to Central Monterey Bay, followed in the future by reclamation.

Meetings in the Santa Cruz area brought out a strong interest in wastewater reclamation. Although the recommended plan for that area was not changed by local input, the AMBAG report emphasizes the need to investigate local reclamation options. Also in the Santa Cruz area there was local opposition to use of secondary treatment and preference was expressed for a physical-chemical alternative. In the southern area, similar concerns were expressed by representation from Goleta.

In the southern portion of the basin, the greatest numbers of questions and comments came during the alternative plan and recommended plan workshops; the most frequently heard comments were related to wastewater recycling, whether for agricultural reuse or for possible return to the public water supply. The Santa Barbara area appeared to be particularly oriented to this topic. Another topic receiving attention was the problem of water softener brine regeneration and the effect this had on land disposal in areas such as Santa Maria and Lompoc; water supply improvements were of considerable interest in these areas. Details of recommended plans were discussed with various discharger groups; in some cases, options were retained for more detailed review in project reports; in others, clear preferences could be established. Relative to non-point waste sources, agriculturalists in the southern portion of the basin pointed out the shortcomings of original animal population projections which were subsequently scaled down; input was also received from agricultural representatives concerning areas of irrigated land.

Chapter 9 Policies and Guidelines

Federal and State laws plus local policies have been enacted which establish the requirements for adequate planning, implementation, management and enforcement, including penalties for non-compliance for the control of water quality. In addition, Federal "regulations" and State "regulations" and "plans" have been developed to augment and clarify the laws and to provide detail not included in the law. Regulations and plans are adopted by the authoritative governmental body and therefore have legal stature and are enforceable. Federal "guidelines" and State "policies" on the other hand, express the intent of the governing body and, while they are not legally enforceable, they establish mandatory constraints on the Basin Plans and otherwise set forth firm direction that should be followed to achieve the goals expressed in the laws. Guidelines are more often associated with the idea of standards or limiting values which express further the details of conformance required by, or implied in, the laws, regulations, plans and policies. These documents are concerned with implementation of the intent of the law.

Laws and related regulatory policies, plans and guidelines administered by the State Water Resources Control Board and the Central Coastal Regional Water Quality Control Board are discussed in the next chapter. This chapter will cover water quality regulatory functions of Federal, local and other state agencies as they relate to this Basin Plan.

FEDERAL LAWS AND REGULATIONS

One Federal law specifically and directly addresses the matter of water pollution control. This law, known as the Federal Water Pollution Control Act Amendments of 1972 was passed by the Congress on October 18, 1972. Several other Federal laws, classifiable as "environmental" laws, also bear upon the planning program. Chief among these is the National Environmental Policy Act, Public Law 91-190, approved January 1, 1970. Emphasis will be given to these two laws in subsequent sections. Another of the environmental laws which impacts upon the program to some extent is the Clean Air Act, Public Law 91-604. The impact of this law will be described briefly.

Federal Water Pollution Control Act, Amendments of 1972

The objective of the Act is to restore and preserve the integrity of the nation's waters. Goals and policies set forth to achieve this objective are (1) to eliminate the discharge of pollutants to navigable waters by 1985; (2) to provide water quality which protects and fosters propagation of fish, shellfish and wildlife and allows recreation in and on the water by 1983; (3) to prohibit discharge of toxic pollutants in toxic amounts; (4) to provide financial assistance to construct publicly owned treatment systems; (5) to develop and implement areawide waste treatment management plans; and (6) to develop technology necessary to carry out these goals. It is the policy of Congress to recognize the rights of the states to prevent and eliminate pollution and to plan the development and use of land and water resources.

It is also the desire of the Congress to encourage full public participation in the development and/or revision of any regulations, plans and programs. The responsibility of administering the Act is placed with the Administrator of the Environmental Protection Agency (EPA).

The 1972 Amendments to the Act are set forth in five Parts or Titles, applicable portions of which are summarized below. When used in the Act, and in the summary below, the words "pollution" and "pollutant" shall mean the following: (a) "pollution" means the man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water; and (b) "pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.

Title I. Research and Related Programs

The goals and policies of the Act described above are contained in Title I. In addition, the law requires the administrator to develop, in cooperation with Federal, State, and local agencies and industries, comprehensive programs for preventing, reducing or eliminating pollution and improving the quality of the nation's waters. These programs must set forth the actions necessary to conserve such waters for the protection and propagation of aquatic life, wildlife, recreation, and public, agricultural and industrial water supply. Grant monies are offered to fund up to fifty percent of the administrative expenses for up to three years for any capable planning agency engaged in development of such a water quality management program. To receive a grant, the plan must (a) be consistent with established quality standards, effluent limitations and discharge regulations, (b) recommend the most effective and economical system for collection and treatment and elimination of pollutants, (c) recommend maintenance and improvement of water quality and adequate financing to implement the plan and (d) be consistent with any areawide plan developed pursuant to sections 208 and 303e of the Act. Additional grant fund limitations are imposed (sec. 106e) beginning in 1974 in that any state receiving funds (e) establish an acceptable surveillance and monitoring system for gathering, analyzing, and reporting water quality data and (f) possess emergency power to immediately restrain any discharge of pollutant which presents an imminent and substantial hazard to the health and, if their livelihood is threatened, the welfare of the people.

Title II, Grants for Construction of Treatment Works

The purpose of this title is to provide the means to develop and implement the waste treatment management plans. Implementation is to be affected by application of the best practicable waste treatment technology before discharge, including reclaiming and recycling, and confined disposal of pollutants (sec. 201 a and b). Planners must consider (a) areawide or regional control of point and nonpoint sources, (b) construction of revenue producing facilities, (c) integration of municipal and industrial treatment and recycling systems and (d) plans which combine open space and recreational opportunities with waste treatment management (sec. 201 c-f). Grant funds are offered to any state, interstate or local agency for the construction of publicly-owned treatment works (sec. 201g) in the amount of 75 percent of the cost of construction (sec. 202a).

Limitations on grants are (a) such works must be in conformance with any applicable areawide waste treatment management plan under section 208, (b) such works must conform to any applicable state plan under section 303e, (c) such works must enjoy certified priority in accordance with the State plan under section 303e and (d) the applicant agrees to pay non-federal costs and maintain and operate the facility (section 204a). Further grants will not be approved unless the applicant has (e) adopted a system of user charges, (f) provided for repayment by industry of its share of construction costs and (g) possesses legal, institutional, managerial and financial capability to construct and operate the facility (sec. 204b(1)). Section 204b(3) describes how industry repayment will be handled.

To encourage and facilitate areawide waste treatment management planning, the Act provides for the designation by the State of areawide planning agencies (sec. 208a) and areawide management agencies (sec. 208c). The State must act as the planning agency for areas not so designated. Planning agencies are given one year to have in operation a continuing areawide waste treatment planning process consistent with section 201. Requirements of the plan prepared under this process are detailed in the Act (sec. 208b(2)). The State must similarly designate the areawide waste treatment management agencies which must implement the areawide plan. Management agencies must have the capability and authority to design, construct and maintain facilities, accept grants, raise revenues, incur indebtedness, establish user charges, prepare and enforce use ordinances and accept industrial wastes for treatment. Grant funds are available for the planning agency operations.

Title III, Standards and Enforcement

This title sets forth the standards for discharge of wastewaters (sec. 301), provides for establishment and Federal approval of water quality standards (sec. 303a), requires each state to classify and rank its surface waters as to severity of pollution (sec.303d) and requires each state to develop a statewide planning process (sec. 303e).

Effluent limitations are established for point sources as set forth in Table 9-1 (sec. 301).

More stringent limitations, including elimination of discharges, shall be established by July 1, 1977 (sec. 301b(1) and sec. 302a), if necessary to meet water quality standards, treatment standards or discharge requirements. Discharge of radiological, chemical and biological warfare agents and high level radioactive wastes is prohibited (sec. 301f). The Act requires the establishment of water quality objectives (standards in the language of the law) for all waters of the State (sec. 303a), with a requirement to review these objectives periodically (sec. 303c). States are required to compare the established objectives with the expected decrease in pollution upon application of the effluent limitations and identify water segments where the objectives, including thermal objectives, will not be attained and establish a priority ranking for all such waters based upon severity of pollution and establish beneficial uses (sec. 303d). The State is also required to compute the total maximum daily load for those pollutants causing effluent limitation levels of treatment not to meet quality objectives. These computations are to allow for seasonal variations and a margin of safety for inadequate knowledge of the relevant factors (sec. 303d).

Each state shall develop and implement a continuing water quality planning process (sec. 303e). The purpose of the process is to provide the states with the water quality assessment and program management information necessary to make centralized coordinated water quality management decisions. Through the continuing planning process, an annual strategy will be developed for directing resources, establishing priorities, and scheduling of actions. The process also provides for the development of basin plans, an integral part of the process. This portion of the process must include (a) schedules of compliance with effluent limitations, (b) applicable areawide plans prepared under sections 201 and 208, (c) total maximum daily loads of pollutants for water quality class segments, (d) procedures for plan revisions, (e) authority for intergovernmental cooperation, (f) provisions for adequate implementation of the plan, (g) controls for disposition of water processing residual streams, and (h) an inventory and ranking in order of priority of facility needs.

Under section 306, any new source of waste discharge must operate without violation of any applicable standard of performance. A new source is one constructed after adoption of the standards of performance. The standards of performance, which are being developed by EPA, are effluent limitations to be placed on the discharges from new industrial sources. The states must develop an enforcement procedure. For the case where discharge is made to a publicly-owned treatment works, pretreatment requirements are to be established for those pollutants not susceptible to treatment or which would interfere with the operation of such treatment works (sec. 307b).

With regard to thermal discharges only, the law provides that less stringent effluent limitations can be set forth where the discharger can demonstrate, after public hearing, that adverse effects to fish, aquatic biota and wildlife are not caused by the discharge (sec. 316a). Standards for point source discharges shall require the design of cooling water intakes to reflect the best technology available for minimizing adverse environmental impact (sec. 316b).

Title IV. Permits and Licenses

Title IV establishes the permit system which controls discharges to navigable waters. The law (sec. 402) requires a license or permit for any discharge into navigable waters. The permit must set forth any effluent limitations, including prohibitions, and monitoring requirements necessary (sec. 401) to assure compliance with applicable effluent limitations of sections 301 or 302, standards of performance of section 306, any prohibition, effluent standard or pretreatment requirement of section 307 or with any appropriate state requirement. States having a permit procedure acceptable to EPA may be authorized to operate the permit program. In any case where disposal of sewage sludge would result in any pollutant therefrom entering navigable waters, such disposal is prohibited except in accordance with a permit issued under section 405a.

Title V. General Provisions

Except for the definitions contained in section 502, this title does not impose any requirement pertaining to the Basin Planning Program.

National Environmental Policy Act of 1969 (NEPA)

In general, this law directs the preservation of acceptable environments and the restoration of those that have been degraded. The method that has been devised to accomplish this is to force the evaluation of the effect of each action on the environment and to consider the result in making decisions regarding the action. The lead in this method was provided by NEPA which applies only to the actions of the Federal Government. However, the ideas and methods of NEPA have been accepted by many state and local governments to the extent that even private actions under local regulations must now submit to assessment of their effects on the environment.

NEPA declares a continuing policy for all levels of government and concerned public and private organizations to create and maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of present and future generations. The Act directs an interdisciplinary approach to insure integrated use of all talents in planning and decision making having impact on the environment (sec. 102). Every report or recommendation must be accompanied by a detailed statement by the responsible official on (1) the environmental impact of the proposed action; (2) any adverse environmental effects which cannot be avoided if the action is taken; (3) alternatives to the proposed action; (4) relationship between local short-term uses of the environment and maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitments of resources if the proposed action is taken. Appropriate alternatives to proposed actions must be studied and developed when conflicts in use of available resources are encountered.

The Clean Air Act

The present Federal air pollution legislation is known as the Clean Air Amendments of 1970, PL 91-604 (December 31, 1970). The Act is a comprehensive piece of legislation establishing air quality control regions, standards and research grants and requiring the states to develop and implement an air quality control plan. It provides for Federal approval of the state's plan and Federal enforcement of the plan in case the EPA Administrator finds that the state is failing to enforce it.

The impact of the Clean Air Act on the water quality control plans is felt in an indirect way in those areas described as "air critical" wherein the air quality is below standard. Air quality is directly related to population and will influence population growth in air critical areas by limiting the extension of urban wastewater collection and treatment and other facilities. This is being carried out through the Clean Water Grants Program of the State of California as described later in this chapter.

Noise Control Act

The Federal Noise Control Act of 1972, PL 92-574 is companion legislation to the water and air related Acts treating the problems of noise emissions. This law establishes standards and enforcement provisions and places the primary responsibility for noise control on the state and local governments. The impact of this Act on the water quality control plan is through the environmental considerations in the location of wastewater treatment facilities, units of which may require consideration of noise levels and their effect on the local government.

Regulations

There are several regulations related to the Federal Water Pollution Control Act. The Act specifically mentions or infers that 38 different regulations must be formulated during the initial year of the Act. Many of these regulations have not yet appeared, some have been issued in draft form and only a few have been published in final form. About half of these regulations apply to the basin planning program.

The regulations which have been issued, in one state or another of finality, and which pertain to the planning program, are listed below:

Section	Title
101e	Regulation for Minimum Guidelines for Public Participation in Planning Process (40 CFR 105)
106e	Regulations for Monitoring of Quality of Water (40 CFR 35, Appendix A)
201	Regulations for Grants for Facilities Construction (40 CFR 35)
208a	Regulations for Areawide Waste Treatment Management Planning Agencies (40 CFR 126)
304d	Secondary Treatment Information (40 CFR 133)
307b(1)	Pretreatment Standards (40 CFR 128)

The present planning program generally conforms to the requirements of these regulations. Other regulations to be promulgated prior to completion of this Basin Plan will not necessarily have an effect on the Plan.

Regulations setting forth "Procedures for Preparation of Environmental Impact Statements" have been published in the Federal Register (40 CFR 6).

Guidelines

The Federal Water Pollution Control Act calls for several sets of guidelines, but many have not yet appeared. A detailed analysis of the Act shows nineteen guidelines are required. Those guidelines which have been issued in one state of finality or another, and which pertain to the planning program are listed below:

Section	Title
212c(2)	Cost-Effectiveness Analysis Guidelines (40 CFR 35)
303a	Developing or Revising Water Quality Standards[1]
304d	Effluent Reduction by Secondary Treatment
307a(1)	Proposed List of Toxic Pollutants (40 CFR 129)
404b	Dredged or Fill Material

The present planning program generally conforms to the limitations expressed in these guidelines but may not conform to the remaining guidelines to be issued.

The Council of Environmental Quality on April 23, 1971, issued "Guidelines for Federal Agencies under the National Environmental Policy Act" for preparing detailed environmental statements on proposals for legislation and other major federal actions significantly affecting the quality of the human environment. The EPA issued "Environmental Assessments for Effective Water Quality Management Planning" to give guidance where needed to planners responsible for preparing environmental assessments in basin, metropolitan and regional water quality management plans.

STATE AGENCY PLANS AND POLICIES OTHER THAN STATE OR REGIONAL BOARDS

The laws in California are organized into the Constitution and 28 Codes encompassing all facets of the State's governmental controls. Laws having an effect on water resources planning are contained principally in the Water Code and to a lesser extent in the Health and Safety, Public Resources, and Fish and Game Codes. The following chapter will consider the Water Code, while this section will deal with water quality considerations contained in the other Codes.

California Environmental Quality Act of 1970 (CEQA)

CEQA is contained in sections 21000 to 21150 of the Public Resources Code. It has been amended by AB301 of the 1972 Session. CEQA requires all State agencies, boards and commissions to include, in any report on any project having significant effect on the environment, an environmental impact statement. CEQA requires, in addition to the five items set forth in section 102 of NEPA, that the statement include a discussion of mitigation measures proposed to minimize the impact. It further requires consultation with and comments from any governmental agency which has jurisdiction or special expertise with respect to any environmental impact involved. AB 301 requires that the boundaries of the area which may be affected by the project be identified and that the growth-inducing impact of the proposed action be included in the statement. The responsibility for development of objectives, criteria and procedures to assure proper preparation and evaluation of the statements was placed with the Office of Planning and Research.

California Administrative Code

Title 17 - Public Health, of this Code contains requirements for quality of water for domestic uses and restrictions on the uses of waters reclaimed from wastewaters.

Other Codes

Portions of various other codes, such as the Health and Safety Code, Fish and Game Code, Public Resources Code, Water Code and Revenue and Taxation Code impose regulation upon the basin planning program. The Health and Safety Code contains regulations relating to the formation and operation of county sanitation and sewer maintenance districts, sewer revenue bonds, the use by the public of reservoirs, and ocean water-contact sport. The Fish and Game Code provides for the preservation, protection and enhancement of birds, mammals, fish, amphibia and reptiles and their habitats and food chains.

The Coastal Zone Conservation Act of 1972, Division 18 of the Public Resources Code is important to the Basin Plans. The law created a Commission and six regional Commissions to prepare a Coastal Zone Conservation Plan by December 1, 1975, and to administer interim control through a system of permits. The permit area is defined as that portion of the zone lying between the seaward limit of state jurisdiction and 1000 yards landward from mean high tide. Development in this area after February 1, 1973, must be approved by the regional commission. Any development which would adversely affect water development, and thus would adversely affect water quality, requires a two thirds majority vote by the commission. The Plan must contain, among other items, a land use element.

Another Public Resources Code law, the California Wild and Scenic Rivers Act, creates a system of natural rivers which must be maintained in their natural state. The law designates certain portions of the Klamath, Trinity, Eel, Smith and American rivers, and several of their tributaries as wild and scenic rivers.

A recent law, Maximum Property Tax Rates for Units of Local Government, SB 90 of 1972 (Revenue and Tax Code, Chapter 15) intends to establish limits on property tax rates in an effort to provide property tax relief. The law provides that the maximum property tax rate shall be that levied by the local government for the 1972-73 fiscal year. This applies to counties, cities and special districts. The law allows certain increases according to a restrictive formula and a rate change by a majority vote in an election called for that purpose. A problem is created by section 2163 which provides that the State will pay to each type of local government, including special districts, an amount to reimburse local government for the full costs of any new state-mandated program or any increased level of service of an existing mandated program. Further, if a local government has been providing a service or program at its option which is subsequently mandated by the State, the State shall pay such local government for such mandated service or program and the local government shall reduce its property tax by the amount of the State payment that replaces property tax revenues expended on such service or program.

Legislative Counsel has interpreted that prohibitions, effluent limitations and recommendations for facilities contained in water quality plans are "State executive regulations" which Assembly Bill No. 1579 added Section 2209 to the Revenue and Taxation Code exemptions State and Regional Board rulings as follow: "Executive regulations" means all mandates having the force of law which directly impose new costs on local agencies by requiring or mandating new programs or increased levels of service of an existing program and which are promulgated by the executive branch of state government. However, this shall not include mandates issued by the State Water Resources Control Board or regional water quality control board pursuant to the Porter-Cologne Water Quality Control Act.

It is the intent of the Legislature in enacting this section that the State Water Resources Control Board and regional water quality control boards will not adopt enforcement orders against publicly owned dischargers which mandate major wastewater treatment facility construction costs unless federal financial assistance and state financial assistance pursuant to the Clean Water Bond Act of 1970 and 1974, is simultaneously made available.

"Major" means either a new treatment facility or an addition to an existing facility, the cost of which is in excess of 20 percent of the cost of replacing the facility."

The California Water Plan

Part 1.5, Division 6 of the Water Code, set forth in 1959, describes the California Water Plan as a "plan for the orderly development and coordinated control, protection, conservation, development and utilization of the water resources of the State which is set forth and described in Bulletin No. 1 of the State Water Resources Board entitled 'Water Resources of California', Bulletin No. 2 by the Board 'Water Utilization and Requirements of California', and Bulletin No. 3 of the Department of Water Resources entitled 'The California Water Plan', with such amendments, supplements and additions to the plan as it is found necessary and desirable...". As previously indicated, State policy for water quality control shall become a part of the California Water Plan.

Central Valley Project-State Water Project Commitments

Central Valley Project - State Water Project Contractual Commitments, Section 11500 of the Water Code, provide that the Department of Water Resources cooperate with the Federal Government in developing and using the water resources of the State.

Both agencies plan to import water into the Central Coastal Basin and the Bureau now operates some storage and diversion projects. See chapter 13.

LOCAL POLICIES

Local considerations such as community goals and objectives may be in various stages of development and unattainable for review and consideration in the development of the recommended plans contained in chapter 5. A purpose of the extensive public review of the plan as outlined in chapter 8 is to expose the plans to community groups for review. Recognizable inconsistencies have been considered and will provide an opportunity for uncovering additional areas of conflict.

The Recommended Plans contained in this document will be further developed in the project reports in full cognizance of all county, city and agency policies. Attendant revenue programs and environmental impact statements will also address the planning for, or inconsistencies with, the several county, city and special district codes and policies.

REFERENCES

I. EPA, "Guidelines for Developing or Revising Water Quality Standards", Washington, D.C., January, 1973.

2. EPA, "Environmental Assessments for Effective Water Quality Management Planning", Washington, D.C., April, 1972.

Chapter 10 Planning Relationships

Planning is in-depth consideration of the future and arranging, beforehand, for a set of actions which will lead, through an orderly process, to attainment of a goal. Planning is universally accepted as an indispensable management tool providing those individuals charged with making policy and management decisions which often necessitate the expenditure of large sums of money with the necessary information on the probable consequences of a particular course of action.

When the goal is preservation or enhancement of the evironmental, social and economic integrity of all the people, planning takes on serious and complex dimensions. Planning of this sort must accommodate, to the maximum extent possible, the inevitable divergencies of interests as well as providing a technically efficient solution to the problems of water quality management. This report is a statement of the goals, a record of the thoughts passed through in the development of a recommended plan and a statement of the recommended plan for the Central Coastal Basin. This plan does not address the full dimension of the goal to preserve or enhance the whole of the environment, but rather it is only one of a subset of several plans dealing with the water resources of the State of California. The relationship between this plan and the other components of the several plans, both higher and lower in the hierarchy of planning levels, is described in this chapter. This plan has been developed through a program conducted by the State Water Resources Control Board in fulfillment of requirements of Section 303(e) of PL 92-500. This is the first attempt to develop a comprehensive plan on a basin-wide basis and with proper regard to the interrelationships of water quantity and quality. This basin plan has been developed with full consideration of other water and related resource plans and planning programs. The more pertinent of these plans are described later in this chapter.

Water resources planning is conducted at various levels of detail. Levels of planning for water resources are set forth in Federal Regulations developed in response to the Water Resources Planning Act (PL 89-80). The "Principles and Standards for Planning" of the Water Resources Council[1] establishes three levels of planning, each of which must consider national economic development and environmental quality objectives. These levels are described as follows:

Level A: "Framework studies and assessments are the evaluation or appraisal on a broad basis of the needs and desires of people for the conservation, development and utilization of water and land resources and will identify regions or basins with complex problems which require more detailed investigations and analysis, and may recommend specific implementation plans and programs in areas not requiring further study."

Level B: "Regional or river basin plans are reconnaissance-level evaluation of water and land resources for a selected area. They are prepared to resolve complex long-range problems identified by framework studies and assessments and will vary in plan formulation; and will identify and recommend action plans and programs to be pursued by individual federal, state and local entities."

Level C: "Implementation studies are program or project feasibility studies generally undertaken by a single federal, state or local entity for the purpose of authorization or development of plan implementation. These studies are conducted to implement findings, conclusions and recommendations of framework studies and assessments and regional or river basin studies which are found to be needed in the next 10 to 15 years."

Although this water quality control plan has not been prepared under the regulations promulgated by the Water Resources Council, it has been prepared at the B level of detail, intended to provide resolution of long-range water quality problems. Level B of planning requires only the detail that will allow the evaluation of concepts developed in Level A planning to determine a recommended plan, the details and refinements of which will be worked out in project planning at Level C.

There are other plans for water and related resources either already prepared or in various stages of preparation which have an influence on this plan and, therefore, have been considered in its preparation. These related plans are described below with an explanation, where it is not obvious, as to how they influence this plan.

WATER AND RELATED RESOURCES PLANNING

Framework Study

Level A planning for the present and projected future development of water and related land resources in California has been completed. The plan, called the Comprehensive Framework Study, California Region, was prepared under the direction of the Water Resources Council pursuant to the Water Resources Planning Act of 1965 (PL 89-80). The region is one of 21 such regions in the United States. The Framework Study, completed in October 1971, is expected to be a guide to the best use of water and related land resources through 2020.

California State Development Plan Program

A planning program undertaken to satisfy the provisions of Title 7, Article 5, Chapter 1.5 of the Government Code resulted in the preparation in September 1968, by the Governor's Office of Planning of the Department of Finance, of a report entitled, "The State Development Plan Program Report." This is a Level A type of report covering the subjects of: (1) California growth characteristics, population and employment; (2) California resources, their management and utilization for the urban state; (3) California urban development, dimensions, implications, requirements; and (4) California development legislation, requirements, restraints, and opportunities.

California Environmental Goals and Policy Planning

Pursuant to Chapter 1534, Statutes of 1970, State of California, the Governor's Office of Planning and Research has prepared a report which provides environmental goals and policies for all levels of government in the State for use in planning future growth and development. This effort is classified as a Level A state plan for areas of concern including air, land use, noise, pesticides, population, solid waste transportation and water. The first report was published on March 1, 1972, and has been available throughout this planning program. The effect of this Environmental Goals and Policies Report on the plan has been to provide definitions of significant or critical environmental concerns and identifications of areas within the State where planning must be constrained in recognition of these concerns.

Planning Pursuant to the Porter-Cologne Act

The Porter-Cologne Water Quality Control Act, enacted in 1969 and designated as Division 7 of the Water Code, directs each regional board to formulate and adopt water quality control plans for all areas within the region. The plans, including this plan become effective upon approval by the State Board. Plans are adopted by the appropriate regional board to meet the requirements of the Porter-Cologne Water Quality Control Act submitted to the State Board for approval and submitted to EPA for federal approval. Through this adoption and approval procedure, the plan becomes the official federal and state water quality control plan.

California Water Plan

The California Water Plan is a plan for the orderly and coordinated control, protection, conservation, development, and utilization of the water resources of the State and consists of the following reports:

a. State Water Resources Board Bulletion No. 1 "Water Resources of California", 1951.

b. State Water Resources Board Bulletin No. 2, "Water Utilization and Requirements of California", 1955.

c. Department of Water Resources Bulletin No. 3, "The California Water Plan", 1957.

Preparation of these documents began over 20 years ago, and they still constitute the California Water Plan. The Legislature, recognizing the need for modifications to this plan, as a result of changing conditions and advances in technology, has provided for amendments, supplements, and additions to the subject plan.

One such provision is that contained in the Porter-Cologne Act which provides that the water quality control plans adopted and approved by the Regional and State Boards, respectively, shall become a part of the California Water Plan effective when such plans are reported to the Legislature.

Also, pursuant to Section 1005 of the Water Code, the Department of Water Resources conducts a continuing statewide planning program to supplement and amend the California Water Plan. This work is published in the Bulletin 160 series which has been published in 1966 and 1970.

Other State Agency Planning

State agency planning related to water resources is being carried on by the Departments of

Navigation and Ocean Development, Fish and Game, and Parks and Recreation; the Coastal Zone Conservation Commissions; and by the Department of Water Resources in areas of interest in addition to those directly related to the California Water Plan described above.

The Department of Navigation and Ocean Development prepared the California Comprehensive Ocean Area Plan (COAP) under authority of Executive Order 67-25, August 1967, in response to the Marine Resources Conservation and Development Act of 1967. The plan itself has no real authority but is intended to serve as a basis for legislative and administrative action for the best use of the coastal resources.

The Department of Fish and Game prepared, under contract with the Resources Agency as a contribution to the State Development Plan, a California Fish and Wildlife Plan, dated January 1, 1966. The plan has no legal authority and is advisory in nature.

The Department of Parks and Recreation is preparing a California Outdoor Recreation Resources Plan. A preliminary draft for review appeared in July 1971.

The Coastal Zone Conservation Commission, added to the Public Resources Code, Division 18, Section 27000, by initiative act approved November 7, 1972, must prepare, for Commission adoption and submittal to the Legislature by December 1, 1975, a plan to be known as the California Coastal Zone Conservation Plan. The plan is to be "a comprehensive, coordinated, enforceable plan for the orderly, long-range conservation and management of the natural resources of the coastal zone---".[2] Although this plan can have no impact on the present water quality control plan, the regional coastal zone commissions, also provided for in the act, have been established and are in a position to exert influence on the water quality control plan.

The Department of Water Resources planning, other than that related to the California Water Plan, involves special studies and plans designed to solve water resources problems of the State.

In general, the state agency plans serve as statements of policy or inventories of the resources and resources use, and although they carry no legal authority, provide guidance to all other agencies, Federal, State, and local, and to the decision-making entities to further the development of valuable resources. These plans are probably classifiable as Level B in that they are reconnaissance level plans to resolve long-range problems in resources management.

Federal Agencies Planning

Water resources planning is now being performed by a number of federal agencies, among which are Water Resources Council, Bureau of Reclamation, Corps of Engineers, and Soil Conservation Service. The Federal Power Commission is authorized to do water resources planning but has not engaged in it to any significant extent. The Water Resources Council framework planning studies are discussed below. Planning by the other federal agencies is usually project-oriented or is in the form of special studies, sometimes undertaken independently of state and local planning. However, the plans developed must be considered in any State and local planning.

PL 92-500, Section 209(a), requires the President, acting through the Water Resources Council, to prepare, as soon as practicable but not later than January 1, 1980, a Level B plan for all basins in the United States. This plan is to be "...under the Water Resources Planning Act...."[3] This planning effort is not scheduled for completion for several years and no information is now available as to the nature of the study.

Regional and County Planning

With the exception of the AMBAG plan, planning for water supply, sewage disposal and drainage control in the Central Coastal Basin has generally been on a county basis. A few municipalities with mutual problems have combined their resources to plan potential solutions within the framework of the larger regional, County, State and Federal plans.

Water resource planning on the local level is very minimal in the Central Coastal Basin. Historically adequate water supplies and the lack of importation potential, except on a state-wide basis, have not encouraged the formation of regional agencies for water resource planning. Most municipalities develop their own supply and forecast their need on the project level.

Plans that consider water supply along with waste water management are discussed in the next section. The following paragraphs will address the few plans and studies pertaining to water importation and utilization.

A comprehensive water planning study for the City of Gilroy was completed in August of 1972 by the Santa Clara County Flood Control and Water Conservation District. Projections of water requirements were made and alternative sources of water supply were evaluated by the District.

A recent water supply study was made by the firm of Creegan & D'Angelo-McCandless for the purpose of determining the qualities of imported water needed to meet water requirements for San Benito County.

A county-wide Master Water Plan for Santa Cruz County was prepared by Creegan & D'Angelo-McCandless in 1968. The Plan specifies water needs of the county to year 2020 and recommends a water supply development plan to satisfy those needs.

As certified regional planning areas, both San Luis Obispo and Santa Barbara County have adopted water and sewerage facilities plans. In addition, the Santa Barbara County Water Agency has forecasted water requirements and facilities for importation. Water Requirements of Santa Barbara County: 1967 to 1990 contains this information.

WASTEWATER MANAGEMENT PLANNING

Although wastewater management planning is an integral part of this Level B Plan, the detail provided in this plan is not that upon which a project may be designed. Thus, another level of detail in planning will be required before construction can occur.

Section 208 Planning

P. 92-500 recognizes the regional nature of waste treatment management in Section 201(c). The law provides for the designation of areawide waste treatment planning agencies (Section 208(a)) and of waste treatment management or operating agencies (Section 208(c)). The law provides that regions which because of "urban-industrial concentrations" or other factors have "substantial water quality control problems" be identified and for each region there may be established a regional wastewater management planning agency "capable of developing effective areawide waste treatment management plans for such areas." The Governor has the authority to designate these "208(a) agencies." In California that authority was delegated to the State Water Resources Control Board. The Board adopted regulations on December 6, 1973, to administer the activities performed pursuant to Section 208.

Section 201 Planning

The final, detailed planning needed to construct wastewater treatment facilities is carried out by regional or local agencies, usually with the financial aid provided in part by federal grant funds under Section 201 of PL 92-500. All projects to receive grant assistance must be compatible with adopted provisions of the plan. Analysis and evaluation of facility alternatives in the 201 project reports will consist of those identified as meeting goals and objectives of 208 plans and water quality control plans. All known plans underway or approved by the Central Coastal Regional Water Quality Control Board during the formulation of this document are discussed in Chapter 14.

County and Local Plans

Several wastewater investigations and plans have been conducted by counties and municipalities within the Central Coastal Basin. Plans considered in this section differ from those in the former in that these are reconnaissance or investigative level.

Consoer, Townsend and Associates recently completed a wastewater management study for South Santa Clara County in which several alternatives, including consolidation of waste flows at Gilroy, were investigated. Yoder-Trotter-Orlob and Associates have recently completed a water quality management study for Santa Cruz County.

Two public facilities elements of Monterey's General Plan have been approved by HUD and adopted by the Board of Supervisors. The North County Public Facilities Element contains recommendations for water supply and sewage disposal as does the Carmel Valley-Carmel Highlands Public Facilities Element. Presently Monterey County is seeking HUD certification for a county-wide Water/Sewer and Storm Drainage Function Plan. Certain conditions remain to be fulfilled before HUD will certify the plan. The major remaining conditions involve plans for area wide coordination and implementation and procedures for updating the plan.

A Master Water and Sewerage Plan was prepared for San Luis Obispo County by Camp, Dresser and McKee in November, 1971. It incorporates facility plans for water supply and wastewater collection.

The Santa Barbara County-Cities Area Planning Council has completed a water and sewerage element which consists of the following certified documents:

Lompoc Valley Regional Wastewater Management Study and Preliminary Design, Brown and Caldwell, June, 1972.

County of Santa Barbara Water and Sewerage Facilities Plan, Boyle Engineering, June, 1971.

General Plan for the City of Santa Maria, California, Public Facilities and Services, Koebig and Koebig, Inc., October, 1967.

The Association of Montery Bay Area Governments (AMBAG) was formed in 1968 as a regional planning agency to conduct a comprehensive two-year study of water management and waste control for the Monterey Bay Watershed. Included in the Association are representatives from Monterey, Santa Cruz, and San Benito Counties and most of the incorporated cities in those counties in the watershed. Initially the study was funded by the AMBAG agencies and the State and Federal government under the Federal Basin Grants program. With the implementation of the state wide basin planning, the AMBAG study was subsequently incorporated in the Basin Plan for the Central Coastal Plan. A separate report was also published.

OTHER RESOURCES PLANNING

Planning related to other resources must be considered in water resources planning, particularly the land and air resources.

Land Use Planning

Land use planning is a basic need for adequate management and protection of the environment but, unfortunately, little land use planning has been accomplished to date. Land use planning bills have been submitted to the Congress and to the State Legislature. The Governor's Office of Planning and Research, in their March 1972 report, "Environmental Goals and Policies" laid the essential groundwork for a land use policy, and is now preparing a comprehensive land use policy to "define a positive approach to future land use and foster the wise use of our natural resources.[4]

Air Resources Planning

The present federal air pollution legislation, the Clean Air Act, Amendments of 1970, PL 91-604, among other things requires the states to develop and implement an air quality control program. In response, the California Air Resource Board has prepared the "State of California Implementation Plan for Achieving and Maintaining the National Ambient Air Quality Standards", which was submitted to EPA in February 1972. The plan consists of 12 parts. Part I, the State Plan, deals with the aspects of air pollution and its control that are common to several or all of the State's air basins. Parts II through XII are the basin plans for each of the eleven air basins of the State. The plan has been revised three times in less than two years and further revisions are now pending. Implementation of the air basin plans is a function of air pollution control districts generally constructed along county or regional boundaries. The districts must adopt rules and regulations which will achieve the state plan air quality standards. Air resources planning is, therefore, primarily a responsibility of the states. The laws are set up so that failure to implement the plan by one level of government places the burden of implementation on the next higher level.

The air quality plan has influenced the water quality control plan in that constraints on population growth were introduced in an attempt to limit the growth-inducing effect of proposed water and wastewater facilities in "air ciritical" areas. In these areas, the baseline population projections considered were the Department of Finance E-O projections. Further, limits were placed upon sizing of facilities to restrict the extent of oversizing to allow for future growth.

The Central Coastal Water Quality Basin falls in four air administrative basins: San Francisco Bay Area, North Central Coast, South Central Coast and South Coast. Minor variations exist among the regulations adopted by the local Air Pollution Control Districts within the Central Regional Water Quality Control Board, but four general regulations have been enacted. They include: restrictions on agricultural burning; no open burning; direct controls on particulate matter, nitrogen oxides, sulfur compounds and odorous substances from industrial and commercial sources, the formulation, storage, shipment and use of gasoline and solvents. See chapter 11.

Solid Waste Planning

Solid waste planning in California is in its early formative stage. Chapter 342, Title 7.3 of the Government Code, approved by the Governor on July 13, 1972, establishes a Solid Waste Management Board and charges it to develop a state policy for solid waste management by January 1, 1975.

The law provides that "each county, in cooperation with affected local jurisdictions, shall prepare . . . a comprehensive coordinated solid waste management plan, consistent with state policy and any appropriate regional or subregional solid waste plan, for all waste disposal within the county and for all waste originating therein which is to be disposed of outside such county." Each county plan is to be submitted to the Board for approval as to compliance with state policy by January 1, 1976.

Many of the counties have already conducted solid waste studies and plans. They include: Yoder-Trotter-Orlob and Associates, Solid Waste Management Report to the County of Monterey for the Salinas Valley; Garretson-Elmundorf-Zinov-Reibin, Santa Cruz Solid Waste Study-Phase I: Problems for Immediate Action; and Santa Barbara County Estimated Requirements for Solid Waste Disposal 1970-1980.

REFERENCES

1. Water Resources Council, "Principles and Standards for Planning Water and Related Land Resources", Federal Register, Vol. 38, Number 174, Part III, September 10, 1973.

2. Public Resources Code, Section 27001(b).

3. PL 92-500, Section 209(a).

4. Governor's Office, Office of Planning and Research, "Environmental Goals and Policies", March 1, 1972.

SECTION 2. THE BASIN

Chapter 11 Basin Description

This chapter will identify the basin boundaries within its natural geographic province and discuss the major environmental features. Physical characteristics such as location, topography, geology and climate are considered as well as hydrological features including surface water hydrology, groundwater hydrology and oceanography. Some of the physical and hydrological characteristics of the Central Coastal Basin are described at a basin-wide level, while others are organized according to the northern and southern portions.

GEOGRAPHICAL SETTING

As illustrated in Fig. 11-1, the Central Coastal Basin extends in a general northwest to southeast direction along the Pacific Ocean from Pescadero Point in San Mateo County to Rincon Point in Ventura County. Included within the basin area are the counties of Santa Cruz, Monterey, San Luis Obispo and Santa Barbara, as well as the southern portion of Santa Clara, the western portion of San Benito, and small portions of San Mateo, Kern and Ventura counties. The basin is about 350 miles long, 50 miles wide and encompasses an area of 11,274 square miles or approximately 7,221,000 acres.

Illustrated in Fig. 11-2 is the Monterey Regional Planning Area which is referred to as the northern or AMBAG portion of the basin. The planning area comprises that portion of the basin tributary to Monterey Bay and the Monterey Coastal Sub-basin.

The southern portion of the basin, consisting of the San Luis Obispo Coastal area, the Carrizo Plains, the Santa Maria River drainage, the Santa Ynez River basin and the Santa Barbara Coastal Region, is illustrated in Fig. 11-2. This portion contains all of Santa Barbara County plus segments of San Luis Obispo, Ventura and Kern counties. Figs. 11-3A, 3B portray the Basin in more detail.

Topography

Rugged mountains, intermountain valleys and an occasional upland area with moderate relief characterize the Central Coastal Basin. The Southern Coast Ranges, including the Diablo, Gabilan, Santa Lucia, Temblor and Caliente, lie three tiers deep and make up the backbone of the basin. Summits commonly rise to elevations of 2,000 to 4,000 feet; however, a few higher peaks in the southeast exceed 8,000 feet in elevation. Contemporary terrain is the product of uplift that has occurred since the middle Pleistocene, accompanied by considerable folding and faulting; formation of stream and marine terraces occurred late.

The trend of the ranges, relative to onshore air-mass movement, imparts a marked climatic contrast between seacoast, exposed summits, and interior basins. The variations in terrain, climate and vegetation account for a multitude of intricate and different landscapes. Seacliffs, white beaches, cypress groves, and redwood forest along the coastal strand contrast sharply with the dry interior landscape of small sagebrush, short grass and low chaparral. Fig. 11-4 illustrates the topography of the Southern Central Coastal Basin.

Geology

The Central Coastal Basin lies within two geomorphic provinces, the northwest to southeast trending Coast Ranges and the west to east Transverse Ranges. The geology of these ranges is extremely complex with respect to the variety of rock formations and to geologic structure. Interestingly, both of the ranges are comparatively "young", in a geologic sense; the older rocks are probably no older than late Paleozoic.[1] Both the Coastal and Transverse Ranges were formed by intense folding and faulting of extremely complex rock groups. Many of the ranges are individual fault blocks, also intricately folded. Since the geologic structures of the Coast Ranges trend 30 to 40 degrees west of north, the irregular but more northerly trending coastline cuts obliquely across the basic lineation of the ranges. Thus, geologic features that characterize the Coast Ranges extend out onto the continental shelf under the Pacific Ocean. The Transverse Ranges, on the other hand, extend in an east-west direction cutting directly across the structural grain of the Coastal Ranges. Fig. 11-5 illustrates the geology of the southern portion of the Central Coastal Basin.

The basement complex in the basin generally consists of pre-Franciscan plutonic and metamorphic rocks. The metamorphic rocks include schist, marble, gneiss and quartzite which have been derived from sedimentary and igneous rocks. Granite is the most common of the plutonic rocks which also include granodiorite and quartzdiorite.

Franciscan and Knoxville formations of probable

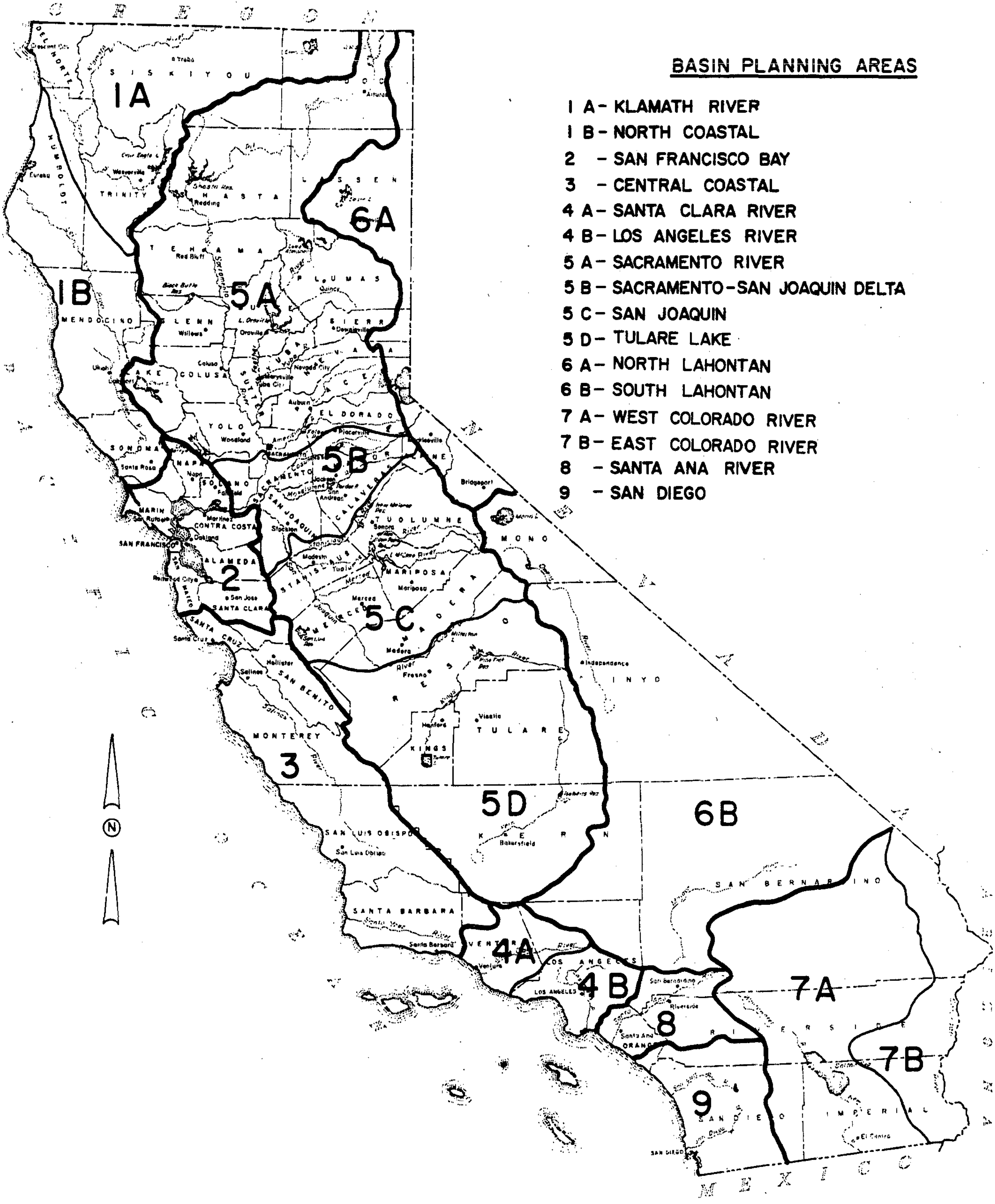

Fig. 11-1 Basin Location Map

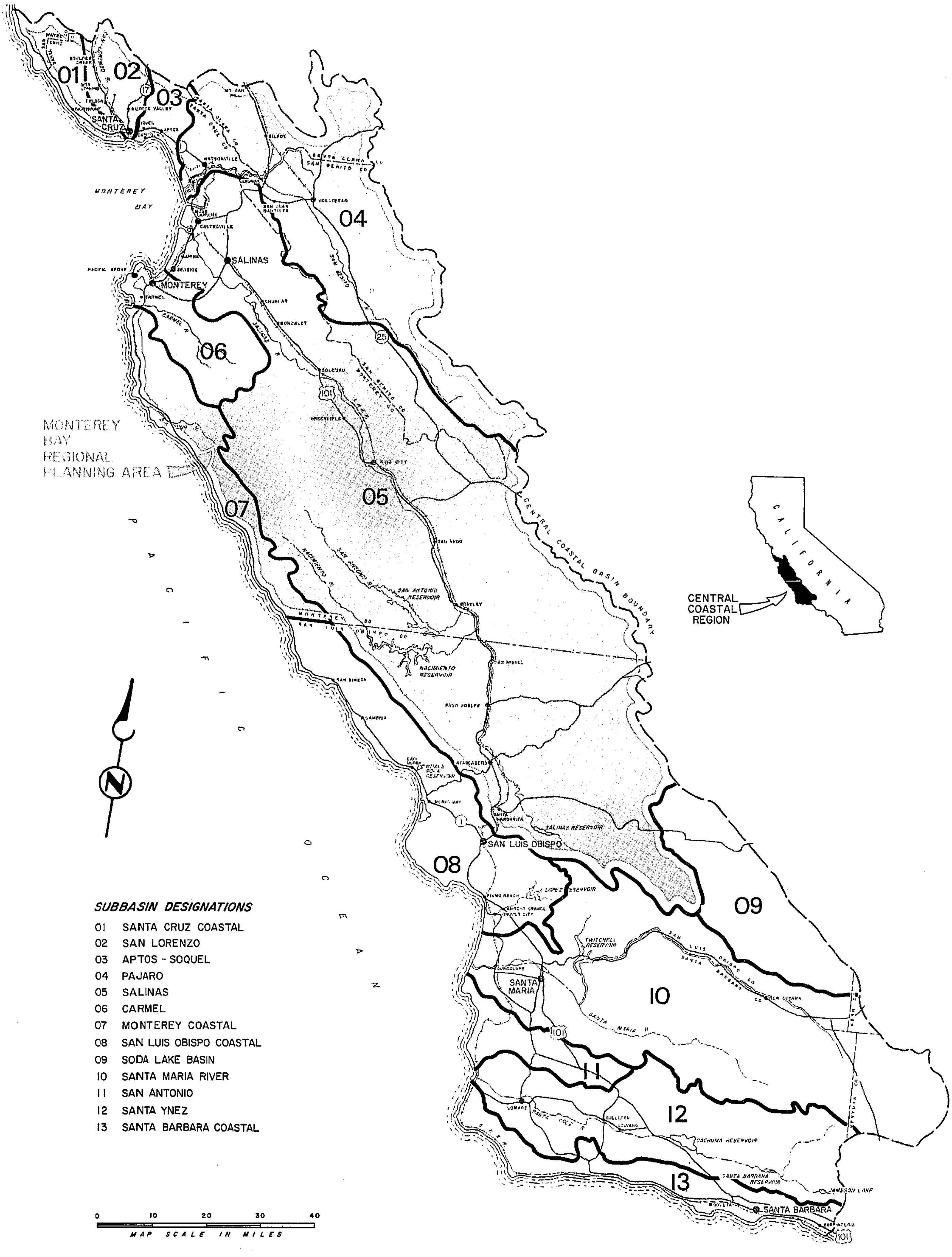

Fig. 11-2 Central Coastal Basin Hydrologic Sub-basin Boundaries

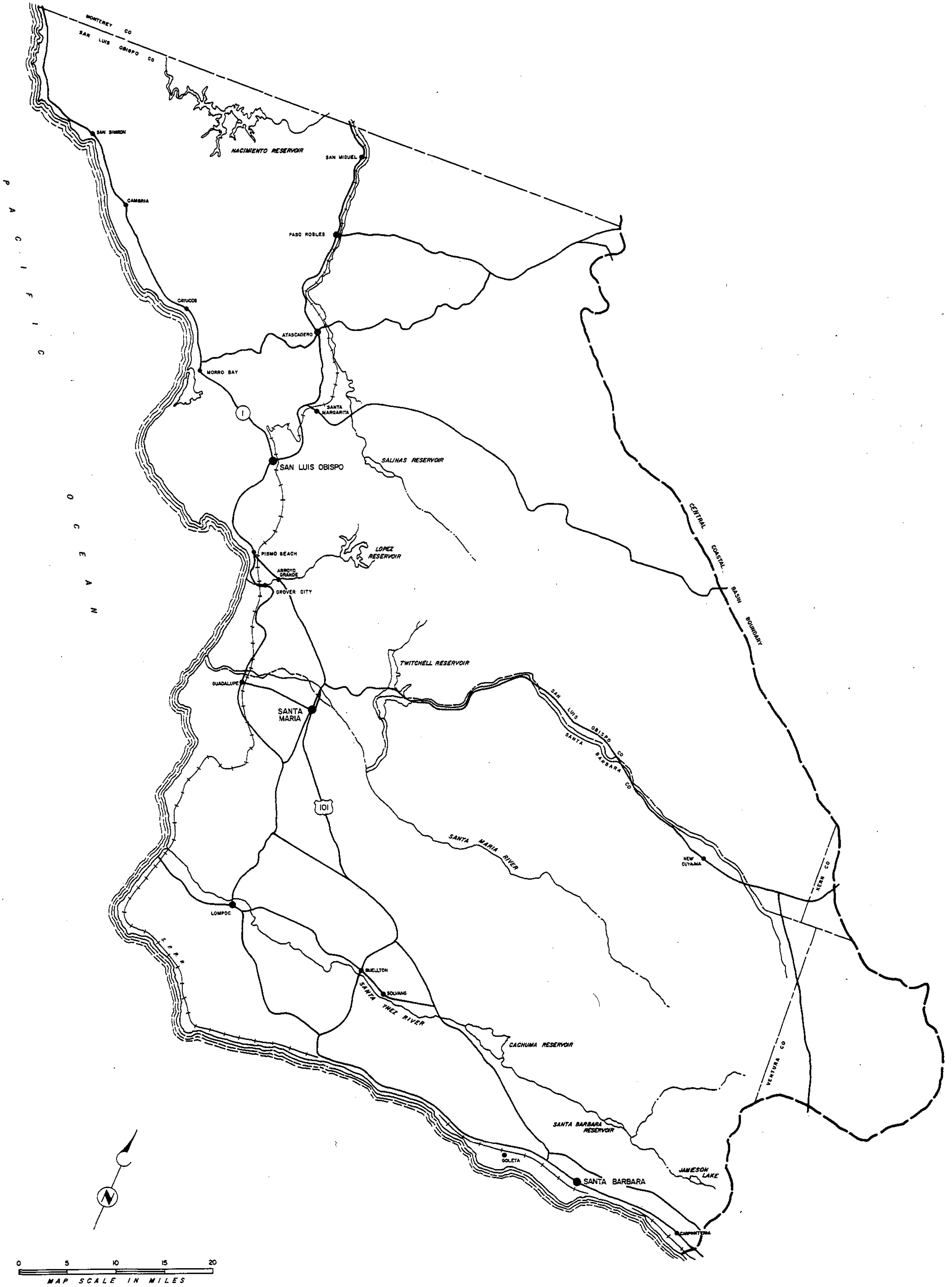

Fig. 11-3A Central Coastal Basin

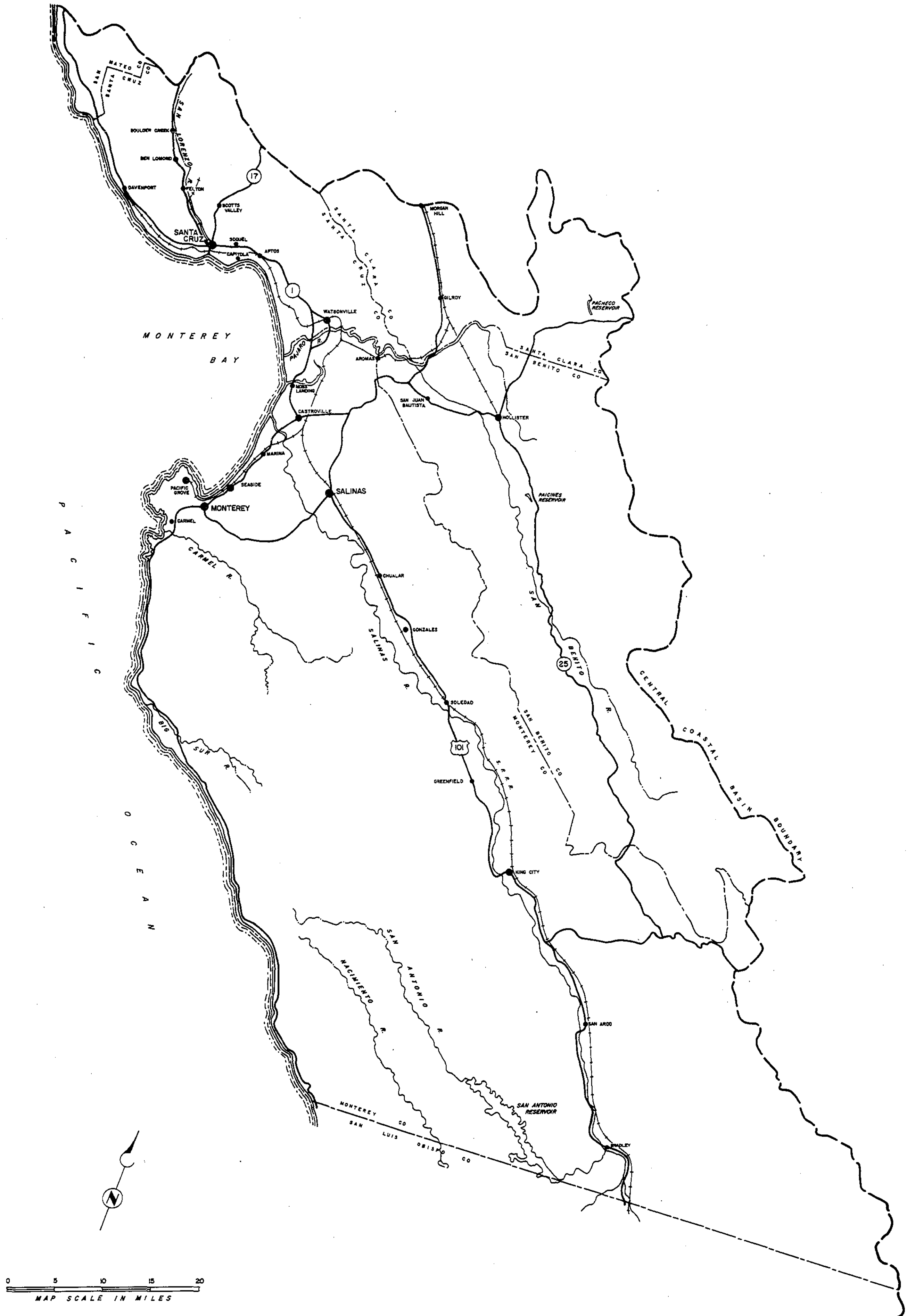

Fig. 11-3B Central Coastal Basin

Jurassic age underlie a considerable portion of the Santa Lucia Mountains. The formation consists of more than 10,000 feet of highly folded and faulted sandstone, shale and minor conglomerate and chert lenses. Noteworthy is the fact that landslides and slumps are common in areas of Franciscan rock. Rocks of the Cretaceous system are found in the Santa Lucia Range, Temblor Range and a small part of the Caliente Range. These formations are composed of up to 14,000 feet of marine sandstone, shale, siltstone, limestone, and conglomerate. Faulting of Cretaceous sandstone has created fractures forming conduits for many flowing springs.

Groundwater basins in most instances conform to geologic features, such as contacts between permeable and impermeable formations, fault zones of low permeability or changes in subsurface lithology which affect movement or mode of occurrence of groundwater. Most groundwater basins consist of unconsolidated sediments or alluvium and fit into one of two classifications. These are (1) the simple basin in which groundwater occurs in a single unconfined body and (2) the complex basin in which groundwater occurs in more than one aquifer and may be confined or partially confined in some aquifers. The smaller groundwater basins along the coast and at higher elevations are essentially of the first type consisting primarily of alluvial fill. Larger groundwater basins, located in the major valleys are more complex, usually consisting of more than a single aquifer and resulting generally from localized folding or faulting.

Water-bearing formations are described more extensively in subsections below for the individual sub-basins. The boundaries of groundwater basins in the Central Coastal Basin are shown in Figure 11-6.

Seismology

Since the California coast is a seismically active area, the possible effects of both earthquakes and seismic fault movement, that is, slow movement along faults not associated with earthquakes, must be considered. Most of the reported earthquakes in California are associated with major fault systems.

Several major fault zones pass through the Monterey Bay Regional Planning Area. These include the San Andreas Fault Zone—the most active and extensive within the state—the Zayante-Vergeles Fault, the Hayward-Calaveras Fault, the Sargent-Paicines Fault, the San Felipe-Hollister Fault and the Paso Robles Fault. Surface evidence of faulting in the Pajaro Sub-basin, through which the San Andreas Fault zone passes, is extensive. In the lower Salinas Sub-basin, on the other hand, surface evidence has been erased:[2]

Notwithstanding the recency of the mid-Pleistocene faulting, there is little direct physiographic evidence of individual faults, although those which brought about the elevation of the Santa Lucia and Gabilan Ranges appear to have been of great magnitude. Erosion and reduction of the surface have been so rapid that all original superficial physiographic effects of the faulting have been quickly obliterated.

However, two faults have been identified in the lower Salinas Sub-basin. These are the Gabilan and the Tularcitos Faults.

Major earthquake activity within the planning area has been centered along the San Andreas Fault Zone. Severe structural damage occurred in the Hollister-San Juan Bautista area and in the South Santa Clara Valley as a result of the April 1906 earthquake. Subsequent to 1906 there have been three earthquakes of magnitude 6.0 (Richter scale) or greater within the southern portion of the basin. Their epicenters have been located on Fig. 11-7. In addition, the Hollister Fault has, in recent years, been associated with numerous smaller earthquakes ranging in magnitude up to 5.7.

Three major fault zones pass through the southern Central Coastal Basin as shown in Fig. 11-7.[3] They are the San Andreas Fault Zone, the Nacimiento Fault Zone and the Santa Ynez Fault Zone. The San Andreas Fault Zone runs the full length of the Central Coastal Basin along its eastern side, the rift zone existing as a prominent feature of the landscape and the Carrizo Plain. Both Nacimiento and Santa Ynez Faults are active to a lesser degree. The former parallels the San Andreas Fault Zone along the coast, while the latter follows the ridge line of the Santa Ynez Mountains. Other, less extensive faults are shown on the geologic map, Fig. 11-5.

Destructive forces accompanying fault movement can cause extensive damage to surface structures. A study of damage to underground structures, however, indicates few reports of ruptured water or sewer lines during any but major earthquakes.[4] Even under these circumstances pipeline damage seems to have been confined to those lines which

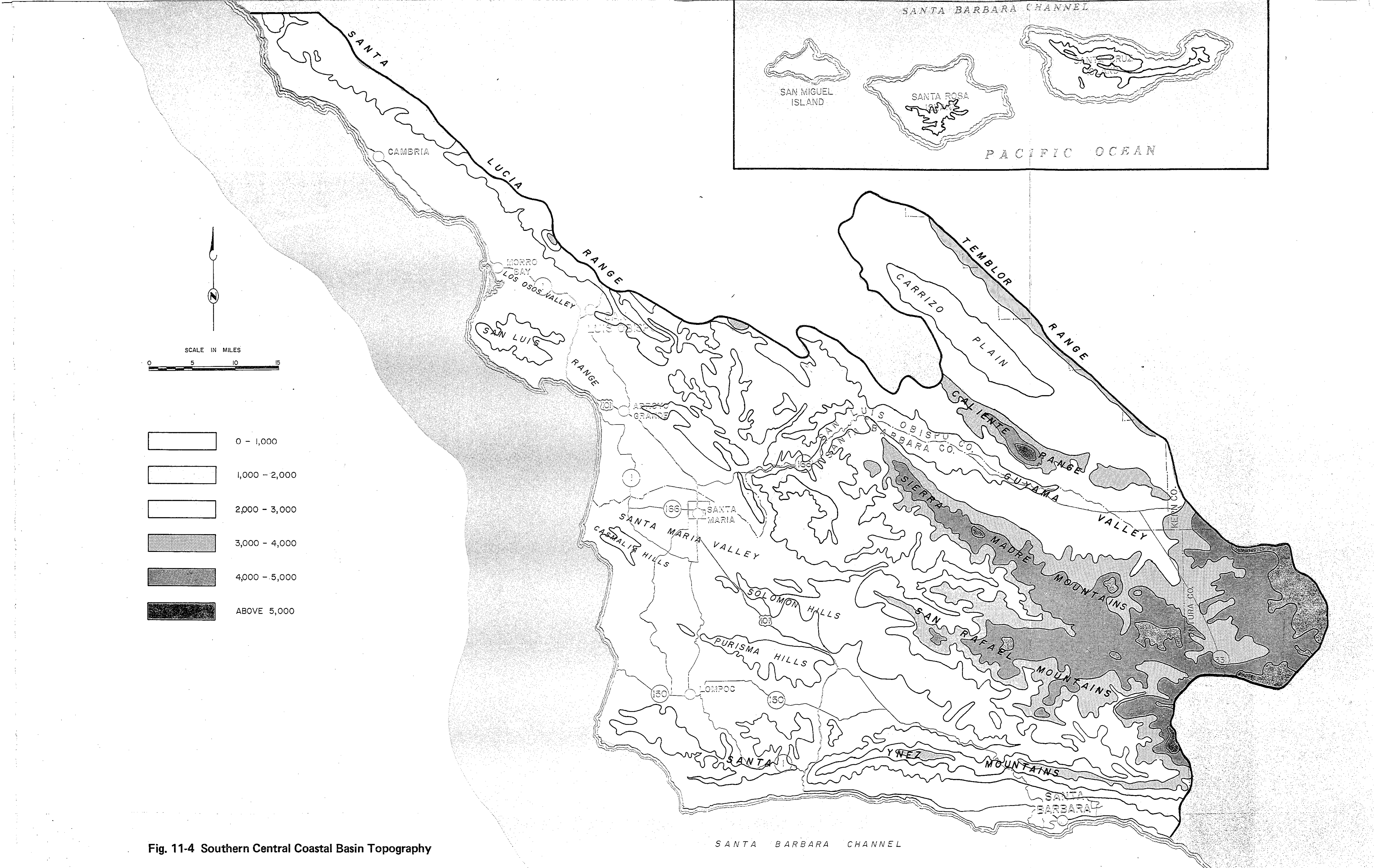

Fig. 11-4 Southern Central Coastal Basin Topography

either crossed a fault or were located in engineered fill near the epicenter of the shock. Except for areas bordering along the San Andreas Fault Zone, the probability of serious seismic damage to subsurface conduits and other structures appears to be remote as the other major fault zones occur at high elevations where extensive development is unlikely. Appropriate precautions in design must be taken both for structures to be located in areas showing the potential for earthquake activity, and for structures constructed on engineered fill, because of their greater susceptibility to damage during a seismic shock.

Pedology

Soils within the Central Coastal Basin vary in physical and chemical properties in accordance with differences in parent material, method of formation or deposition, and age or degree of development since their deposition. The soils may be divided into three broad groups: (1) residual soils, (2) soils that fill older valleys, and (3) recent alluvial soils.

Residual soils include those which have been developed in place on consolidated bedrock of sedimentary, igneous, and metamorphic origin. Soils in this category are found throughout the basin on steeper slopes where drainage is generally good and soils are usually shallow and of medium texture. Rock outcrops are frequently found. Moisture holding capacities are rated as fair to good although, because of unfavorable topography or shallow depths, only a small percentage of soils in this category are suitable for cropping purposes. As these soils occur on steep slopes, they are usually very susceptible to erosion.

The soils that fill older valleys, such as are found in the San Luis Obispo-Arroyo Grande area and the upper Salinas Valley, generally occupy intermediate elevations between residual soils and Recent alluvial soils. Since their deposition, soils of this group have been elevated and later eroded in varying degrees by streams cutting through them. As a result, rolling to flat topography characterizes the areas in which these soils occur. Textures vary from light to medium at the surface to heavy at depth. Surface drainage is therefore good, but subsurface drainage is often retarded by the heavier subsoils. The most highly developed profiles in the basin exist in soils of this group. Moisture holding capacities are fair to good in the upper zones and poor in the lower zones. Failures of shallow rooted, dry-farmed crops on these soils have been reported in years of deficient rainfall. Soils with the most highly developed profiles are fertilized as standard cropping practice. A wide range of climatically suited crops may be grown on older valley-filling soils.

Recent alluvial soils usually occupy flood plains adjacent to stream channels and alluvial fans where accretions and depletions of soil material occur each year. Because this soil is in the process of accumulation, profiles are, at best, in the early stages of development. Soil depths vary considerably, often exceeding six feet. Textures vary from light to medium in the Carrizo Plain drainage area with stratified sands and gravels often found beneath the surface. Heavier textures are found in some soils along the coast. Drainage is usually good in the lighter textured soils except during periods of inundation. In the case of heavier soils, perched water is often found, especially above stratified clays. Such a condition exists in the West Bolsa area. With proper application of water and careful use of commercial fertilizers where required, recent alluvial soils have a high agricultural value.

Climate

The amount and timing of rainfall affects the waste assimilative capacity of surface and groundwater bodies, thereby influencing the method of disposal. High temperatures accelerate the metabolic rate of all organisms, including the bacteria which stabilize organic matter within a sewerage system.

To understand the weather patterns, which in the long run make up the climate of an area, the controls, which in different intensities, amounts, and durations produce changes in the weather, should first be examined. Dominating the controls of the southern central coastal basin climate are: West Coast, Northern Hemisphere continental location, elevation variations, and the direction of the continental-ocean interface.

A significant temperature variation occurs along the coastal strand. Coastal maritime fog is pulled inland by the low pressure due to the diurnal heating. The hotter the inland temperatures, the greater the effect; and the fog flows in along the coastal strand to cool temperatures as far inland as San Luis Obispo and Santa Maria. Average maximum monthly temperatures are highest in September with the cooler average inland temperatures causing less of an indraft. This is portrayed in Table 11-2. Cuyama, an interior station, recorded a corresponding increase in daily maxi-

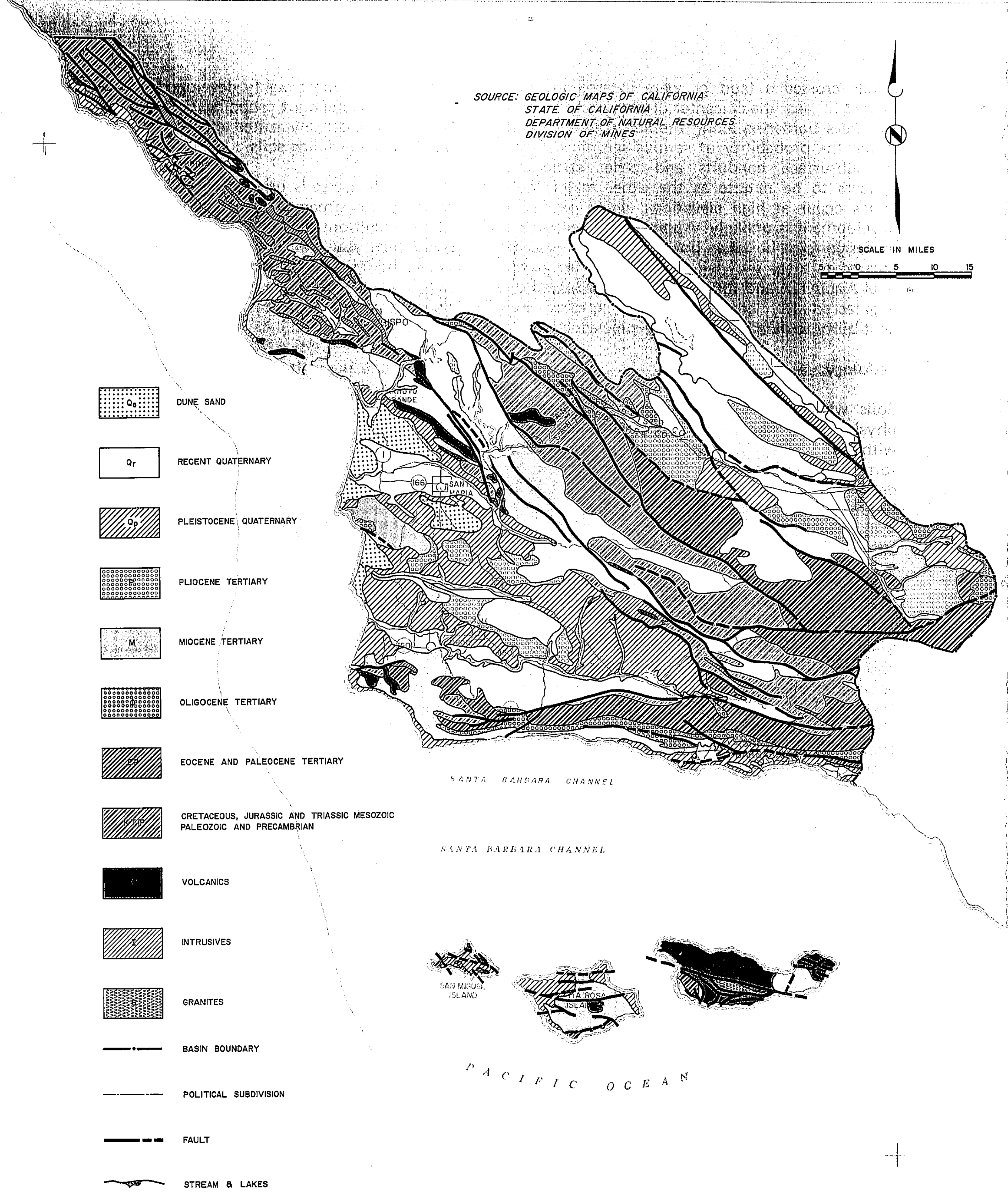

Fig. 11-5 Southern Central Coastal Basin Geology

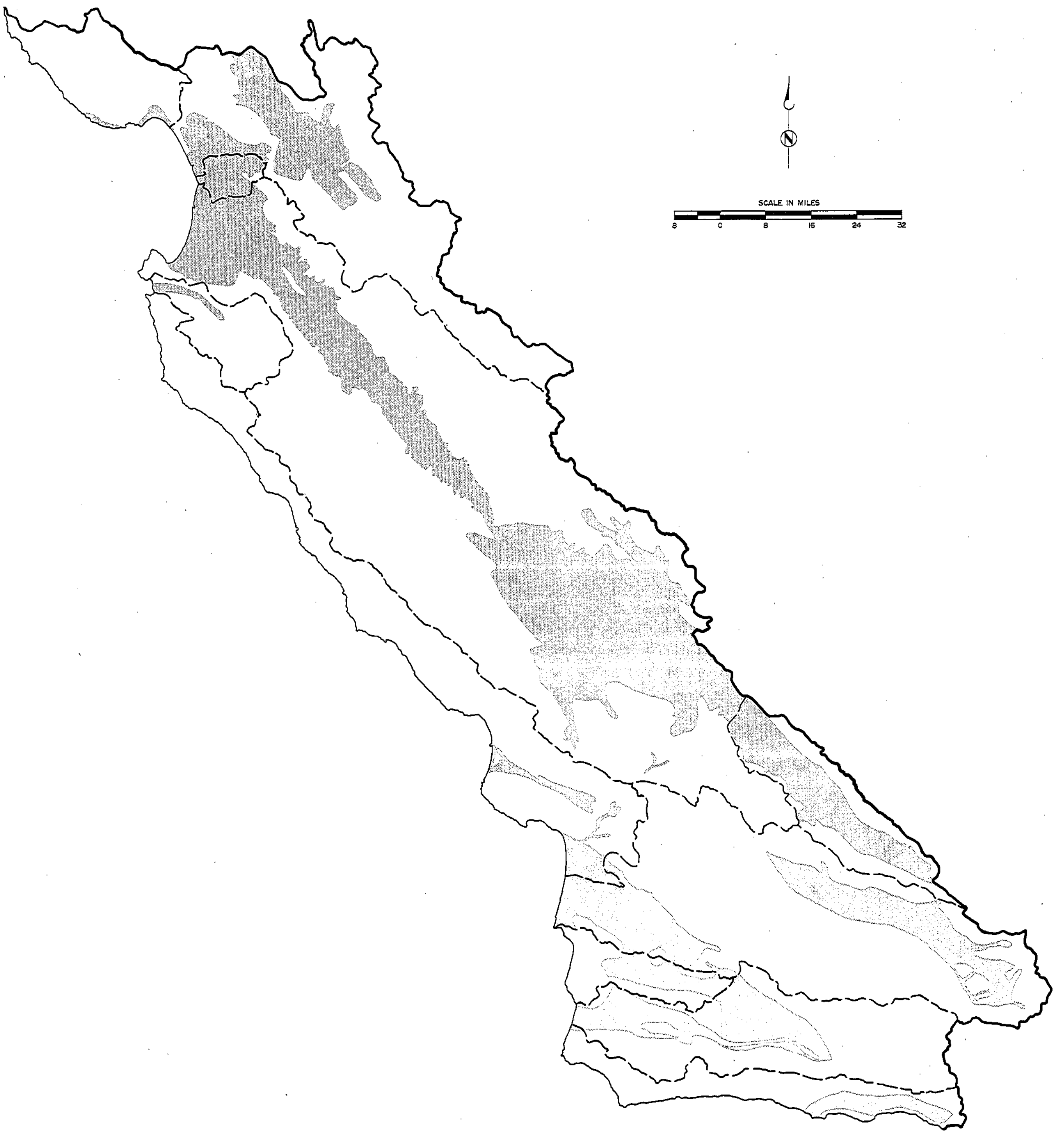

Fig. 11-6 Ground Water Basins

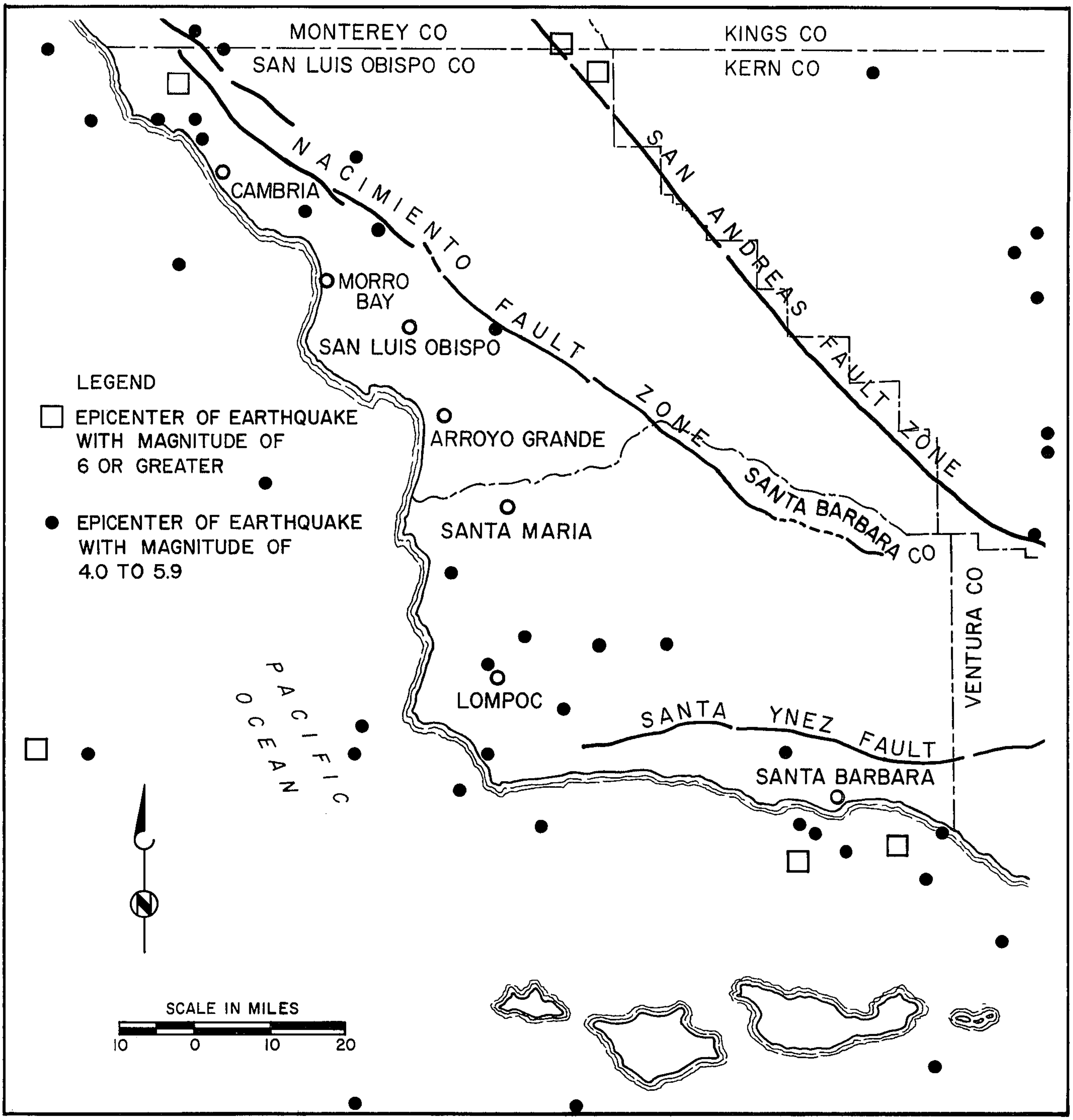

Fig. 11-7 Southern Central Coastal Basin Seismology

mum temperature during the same period due to the increased radiation as a result of decreased cloud cover. The average increase is not as dramatic, due to the longer, cooler nights which partially offset the increase in diurnal temperatures.[5]

The winter seasonal migration of the vertical sun rays to the Southern Hemisphere is followed by a like migration of the polar (middle latitude) storm belt to the vicinity of the United States-Canadian border. The rain-producing cyclonic storms form off shore in the Pacific Ocean and move inland with a wide path of influence. Most storms pass well to the north without purging any moisture in the Central Coastal Basin; however, the more equatorial moisture-laden storms do provide precipitation and some snow. The warm local air is slowly lifted over the cool incoming air, and the discontinuity surface that is formed produces a prolonged light rain.

Two other major controls significantly affect the precipitation pattern. Mountains act to force the discontinuity surface upward, thereby cooling the warm air even more. As the warm air cools, it condenses, losing its moisture-carrying capacity in the form of rain or snow. Thus, the mountains of the area act as a catalyst by influencing the storm fronts, as well as by cooling onshore moisture laden air masses. This type of precipitation-producing uplift is referred to as orographic precipitation. The alignment and height of the mountains of the region is a critical influence in determining the amount of orographic precipitation. The west-east trending transverse ranges, such as the Santa Ynez Mountains, collect less moisture than the higher north -south coastal ranges, such as the Santa Lucia Mountains.

As the air masses descend the east side of the coastal ranges, they come under greater pressure to contract, with a warming effect. The warming effect not only produces no moisture, but it absorbs it as well. Thus, the leeward side of the coastal ranges are much drier than the windward sides.

From the foregoing discussion it is obvious that the Central Coastal Basin contains two distinct climatological regions—the cool summer coastal strand and the hot summer interior. Table 11-1 lists the average monthly temperatures for representative stations in the northern Central Coastal Basin and Table 11-2 lists temperature variations in the southern portion.

Winter variations include a greater rainfall for the coastal strand and lower temperatures for the inland areas. The low humidity does not retain the solar insulation received during the day, and nocturnal temperatures are low. Fig. 11-8 illustrates the precipitation distribution in the northern Central Coastal Basin and Fig. 11-9 illustrates that for the south. Tabulations of the precipitation data for the two areas are presented in Table 11-3 and 11-4 respectively. Evaporation rates are tabulated in Tables 11-5 and 11-6.

Air Quality

The Central Coastal Water Quality Control Basin extends across four air basins—the San Francisco Bay Area Air Basin, North Central Coast Air Basin, South Central Coast Air Basin and South Coast Air Basin. The North and South Central Coast Air Basins are located in the center of the Central Coastal Water Quality Basin with the Montery-San Luis Obispo County Line dividing the two. The southern extremity of the San Francisco Bay Area Air Basin extends a short distance into the northern portion of the Central Coastal Water Quality Basin. The northern extremity of the South Coast Air Basin consists of the Santa Barbara Coastal Sub-Basin, the southernmost portion of the Central Coastal Water Quality Control Basin (see Fig. 1-1).

Like water bodies, air patterns have a finite assimilative capacity. Atmospheric areas which have favorable wind patterns, vertical exchange, and no physical barriers can dissipate a maximum amount of foreign particles.

The principal conditions that constitute air quality degradation are (1) a substantial pollution load, (2) temperature inversions, and (3) a partially enclosed basin. Two of these conditions exist to a degree in the Central Coastal Basin.

The Hawaiian high is a large high pressure system located offshore. In the winter it shifts south to exhibit little influence on the Central Coastal Basin, but in the summer it shifts poleward to create an inversion over the littoral portion of the basin. Winds in the system rotate in a clockwise pattern, descending from high altitudes. As they slowly descend along the coast, they come under more pressure and compress, producing a heating effect. Thus, warm air overlies the surface air.[6] Air in contact with the earth's surface rises during the day as it is warmed by the earth's radiation. Particles suspended in the air ride these convectional currents upward until they come in

Table 11-1. AMBAG Area Average Monthly Temperatures

Station[a]	Temperature, °F												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Hollister	48.8	52.1	55.1	58.4	61.6	65.0	67.6	67.2	67.5	62.6	55.4	50.3	59.3
Salinas	49.7	51.7	53.6	55.7	58.5	60.7	62.0	62.3	63.6	60.9	56.1	51.6	57.2
Santa Cruz	49.0	50.8	52.9	55.3	58.3	61.3	63.0	63.0	63.3	59.8	54.6	50.6	56.8
King City	48.4	50.9	54.0	57.9	62.0	65.4	68.0	67.1	67.1	61.9	54.6	49.8	58.9

[a] Climate of California, U.S. Department of Commerce, Environmental Science Services Administration, June, 1970.

Table 11-2. Variations in Monthly Temperature - Southern Central Coastal Basin

Station	Temperature, °F												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Pt. Piedras Blancas[a]													
Maximum	47.9	57.7	57.5	57.0	58.2	59.2	60.6	60.8	62.5	61.7	62.1	60.1	59.6
Average	51.6	51.5	51.7	51.8	53.0	54.3	55.7	56.0	57.1	56.3	55.5	53.7	54.0
Minimum	45.2	45.3	45.9	46.4	47.9	49.3	50.9	51.3	51.7	50.7	48.8	47.2	48.4
Morro Bay Fire Dept.[a]													
Maximum	62.2	62.7	63.0	63.6	63.9	64.1	65.2	66.6	68.1	71.3	66.7	62.6	65.0
Average	52.7	53.5	53.9	54.4	55.5	57.2	58.6	59.6	60.3	61.2	57.2	53.0	56.4
Minimum	43.1	44.2	44.8	45.1	47.0	50.2	51.9	52.6	52.4	51.0	47.7	43.3	47.8
San Luis Obispo[a]													
Maximum	62.9	64.2	66.6	69.7	71.2	75.2	79.0	79.3	80.4	77.2	71.0	64.5	71.8
Average	51.6	53.1	55.0	57.0	59.2	62.1	64.9	64.7	65.4	63.0	58.7	54.1	59.1
Minimum	40.3	42.0	43.4	44.3	47.3	48.9	50.8	50.0	50.3	48.8	46.3	43.1	46.3
Pismo Beach[a]													
Maximum	62.0	63.8	65.1	66.5	67.3	69.2	68.7	68.7	71.5	71.3	69.0	65.0	67.3
Average	52.0	53.8	54.5	56.3	57.2	59.4	60.5	60.8	61.9	60.5	57.9	54.4	57.4
Minimum	42.0	43.7	43.8	46.0	47.1	49.6	52.3	52.9	52.2	49.7	46.8	53.8	47.5
Santa Maria[b]													
Maximum	62.3	63.1	64.6	66.4	68.1	69.5	71.6	71.9	74.1	73.3	70.4	65.0	68.4
Average	50.2	51.8	53.3	55.6	57.6	59.6	62.2	62.4	62.8	60.4	56.1	52.4	57.0
Minimum	38.1	40.4	41.9	44.7	47.1	49.7	52.8	52.9	51.5	47.5	41.8	39.8	45.7
Cuyama[b]													
Maximum	57.8	60.3	62.8	71.3	77.6	87.1	95.6	93.2	89.0	77.0	67.3	60.3	74.9
Average	43.5	45.9	48.4	55.1	60.0	67.8	74.8	72.9	68.9	58.3	50.5	46.7	57.6
Minimum	29.2	31.5	33.9	38.9	42.3	48.4	54.1	52.6	48.8	39.6	33.6	31.0	40.3
Lompoc[b]													
Maximum	63.3	64.9	65.1	65.7	67.1	68.9	70.6	70.3	73.1	72.8	70.3	66.4	68.2
Average	51.8	52.6	53.3	55.4	57.2	59.3	61.6	61.5	62.3	58.8	56.3	52.9	57.0
Minimum	40.2	40.3	41.5	45.0	47.2	49.6	52.7	52.6	51.5	46.8	42.2	39.3	45.7
Solvang[b]													
Maximum	64.5	64.5	67.8	72.0	72.5	79.6	83.8	80.2	80.6	78.3	71.8	67.8	73.6
Average	49.0	51.8	54.1	56.8	58.0	63.8	67.4	56.6	64.4	61.6	53.9	50.4	58.1
Minimum	33.5	39.0	40.3	41.5	43.5	48.0	51.0	51.0	48.2	44.8	36.0	33.0	42.5
Santa Barbara[b]													
Maximum	64.8	65.7	67.9	69.7	69.7	71.8	73.8	77.7	78.6	75.6	72.8	67.4	72.0
Average	52.6	54.0	56.0	58.6	61.1	63.3	67.1	67.4	66.8	63.1	58.5	54.7	60.3
Minimum	40.3	42.2	44.1	47.5	50.3	52.8	56.5	56.7	54.9	50.6	44.2	42.0	48.5

[a] University of California Agricultural Extension Service, unpublished data.

[b] The Climate of Santa Barbara County, University of California Agricultural Extension Service, United States Weather Bureau, County of Santa Barbara, January 1965.

Fig. 11-8A Northern Central Coastal Basin, Lines of Equal Mean Seasonal Precipitation

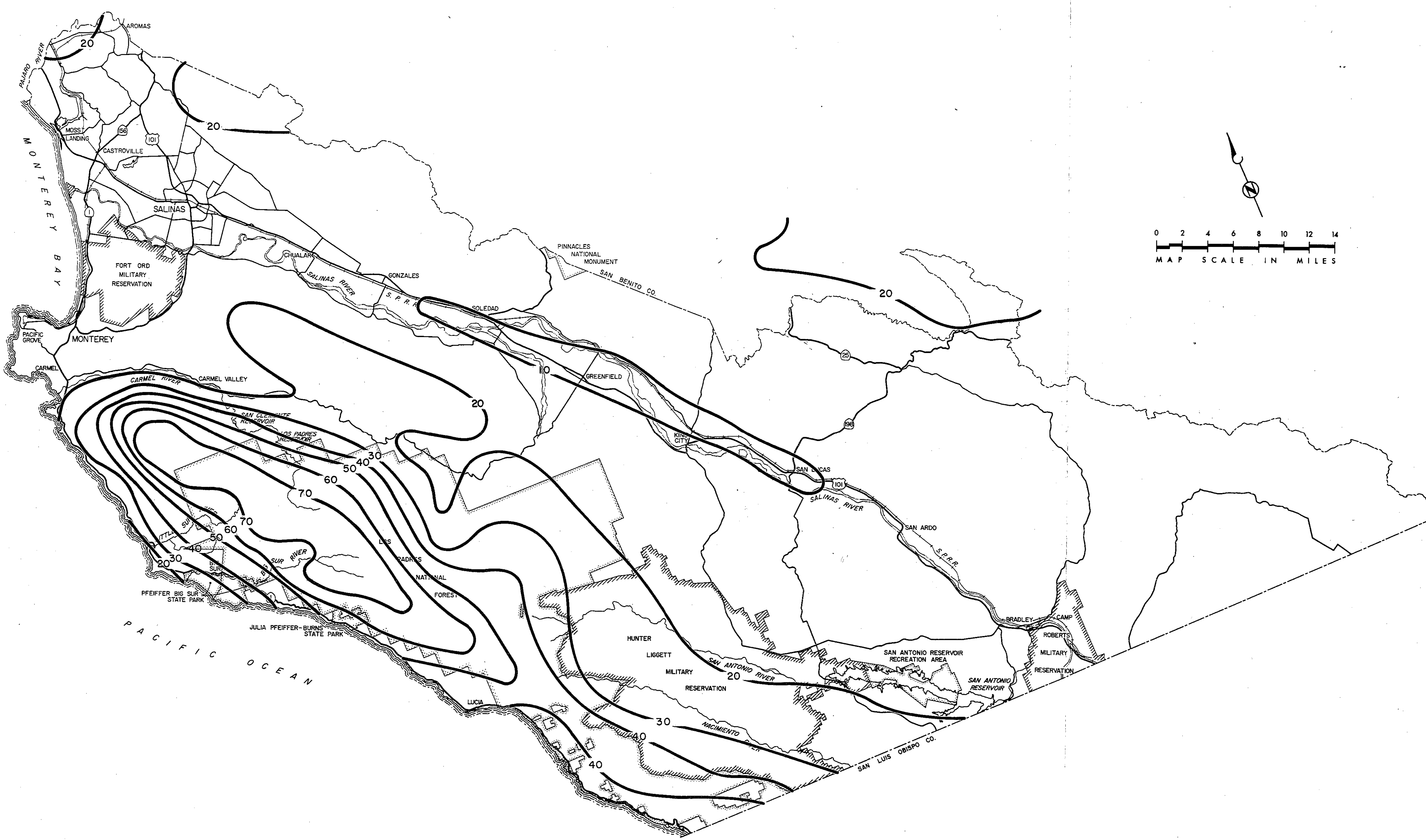

Fig. 11-8B Northern Central Coastal Basin, Lines of Equal Mean Seasonal Precipitation

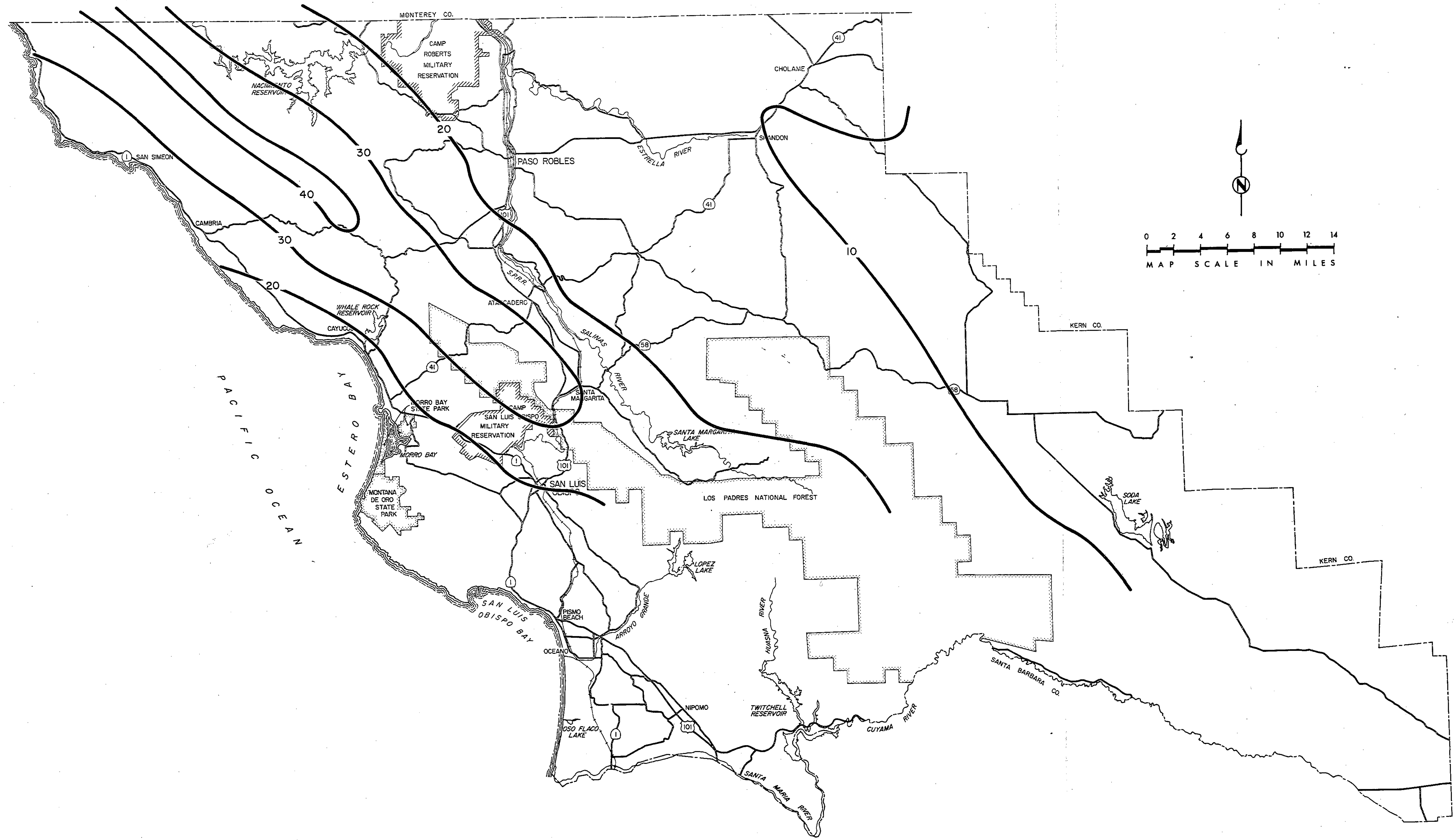

Fig. 11-8C Northern Central Coastal Basin, Lines of Equal Mean Seasonal Precipitation

Fig. 11-9 Southern Central Coastal Basin, Lines of Equal Mean Seasonal Precipitation

Table 11-3. AMBAG Area Average Monthly Precipitation, 1951-70

Station[a]	Precipitation, inches												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Big Sur State Park	10.00	6.33	4.76	3.86	.96	.22	.01	.02	.55	1.45	4.95	8.07	41.18
Boulder Creek, Locatelli Ranch	15.46	8.85	6.98	4.75	1.63	.63	.01	.16	.91	3.19	7.30	12.59	62.47
Del Monte	3.13	2.01	1.61	1.25	.30	.08	.01	.04	.21	.33	1.78	2.50	13.25
Lucia Willow Springs	6.98	4.46	3.26	2.41	.53	.10	.01	.04	.31	.98	3.63	5.03	27.74
Point Piedras Blancas	4.88	3.61	2.75	1.97	.44	.04	.02	.05	.12	.70	2.52	3.68	20.79
Priest Valley	4.71	3.54	2.74	2.03	.53	.05	.06	.01	.24	.56	2.69	3.77	20.94
Salinas FAA Airport	3.03	1.93	1.59	1.30	.29	.10	.01	.03	.16	.36	1.55	2.67	13.03
Salinas Dam	4.93	3.54	2.58	2.39	.35	.05	.00	.01	.21	.43	2.67	3.53	20.68
Santa Cruz	7.12	4.65	3.79	2.58	.62	.24	.02	.10	.32	1.05	3.47	5.79	29.76
Santa Margarita 2SW	7.30	5.28	3.75	3.27	.56	.10	.01	.01	.30	.90	3.92	5.90	31.31
Wright's	11.31	7.23	5.40	3.96	.94	.34	.03	.09	.56	2.11	5.61	9.21	46.80

[a] U.S. Weather Bureau Data.

Table 11-4. Average Monthly Precipitation - Southern Central Coastal Basin

Station	Precipitation, inches												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Point Piedras Blancas[a]	4.40	3.81	3.08	1.69	.41	.04	.02	.04	.08	.80	2.12	3.75	20.24
Morro Bay Fire Dept.[a]	3.62	3.35	2.30	1.58	.30	.05	.02	.02	.10	.65	1,30	3.40	16,69
San Luis Obispo[a]	4.41	4.41	3.10	1.91	.40	.16	.03	.03	.11	.70	1.70	4.57	21.53
Pismo Beach[a]	3.53	3.36	2.00	1.65	.30	.03	.05	.01	.19	.43	1.82	2.53	15.90
Santa Maria[b]	2.84	2.50	2.06	1.19	.22	.14	.03	.03	.16	.60	1.02	2.58	13.27
Cuyama[b]	1.39	1.37	1.12	1.05	.20	.02	.01	.13	.34	.23	.72	1.40	7.98
Lompoc[b]	3.04	1.84	1.93	1.50	.24	.03	.05	.01	.11	.32	1.54	2.04	12.65
Cachuma Dam[b]	3.68	3.07	2.65	2.26	.50	.03	T	.01	.09	.10	1.63	3.10	17.12
Santa Barbara[a]	3.82	3.74	2.74	1.49	.33	.08	.03	.04	.05	.49	1.33	3.49	17.63

[a] University of California Agricultural Extension Service, unpublished data.
[b] The Climate of Santa Barbara County, University of California Agriculture Extension Service, United States Weather Bureau, County of Santa Barbara, January 1965.

Table 11-5. AMBAG Area Variations of Monthly Evaporation, 1969-70

Station[a]	Evaporation, inches												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Soledad	5.25	4.25	2.75	2.57	3.06	5.32	6.68	8.93	8.80	9.18	8.19	7.56	72.54
Spreckels	-	-	-	2.68	3.32	7.09	11.75	10.10	9.42	7.78	10.18	9.81	-
Nacimiento Dam	5.03	2.86	1.75	1.40	2.49	4.52	-	-	-	11.03	9.66	8.10	-

[a] Bulletin No. 130-70, Hydrologic Data 1970, Vol. III: Central Coastal Area, California Department of Water Resources, 1971.

Table 11-6. Variations of Monthly Evaporation - Southern Central Coastal Basin

Station	Evaporation, inches												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Twitchell Dam[a]	3.14	3.82	4.94	5.73	6.54	7.62	9.05	9.01	7.18	6.62	3.84	2.97	69.27
Lompoc[b]	2.91	3.50	4.68	6.03	7.44	8.40	8.40	7.50	6.24	5.42	3.87	3.01	67.40
Solvang[b]	3.10	3.30	5.89	7.74	9.21	10.17	10.04	8.68	7.38	6.37	4.17	3.35	79.42
Cachuma Dam[a]	2.66	3.01	4.64	5.88	7.19	8.47	9.54	9.15	7.12	5.78	3.77	2.68	70.01
Gibraltar[c]	1.29	1.82	3.79	5.12	6.83	7.94	9.66	9.16	7.36	5.09	2.83	1.32	62.21
Goleta[a]	4.06	3.70	5.43	5.58	6.91	7.47	8.06	7.25	6.60	5.67	4.50	3.81	69.04

[a] Climatological DATA, United States Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service.
[b] The Climate of Santa Barbara County, University of California Agricultural Extension Service, United States Weather Bureau, County of Santa Barbara, January 1965.
[c] Evaporation from Water Surface in California, Basic Data 1948, State of California, Department of Water Resources.

contact with the warmer air subsiding off the subtropical high. A distinct interface is formed and the convectional currents move off in a horizontal position unable to penetrate the warm ceiling. With the increase in velocity of the lower onshore winds due to heating, the lower air then moves inland until it either moves away from the influence of the overlying warm air layer, or it encounters a barrier, such as a mountain range, and stagnates.

The subsidence inversion is persistent over the region, with an elevation of 500-1000 feet over the areas north of Point Arguello.[7] The average inversion height over this area is probably lower than in any other part of California, and increases in height to the north, east, and south from San Luis Obispo County. The persistent inversion conditions, the daily reversal of wind direction, and the topographical sheltering in some areas combine to create a potentially adverse air pollution condition for this basin.

A maritime climate occupies the narrow coastal plain of the Central Coastal Basin. The lowland areas along the coast are isolated from the interior by the Santa Ynez Mountains, Santa Lucia Range and Santa Cruz Mountains. Isolation is not complete due to deep landward penetration of the Santa Maria, Santa Ynez and Salinas River Valleys. These topographical characteristics provide the physical conditions which result in the regular occurrence of off-shore drainage at night and on-shore sea breezes during the daylight hours.

Spillover of pollutants from the San Francisco Bay Air Basin aggravates the air quality in the South Santa Clara Valley. Programs now underway to control the Bay Area emissions should alleviate the source of pollution.

The State Air Resources Board has formulated the State of California Implementation Plan for Achieving and Maintaining National Ambient Air Quality Standards.[7] In this plan the State has discussed existing air quality, probable pollution growth, and the probable effects of the State's control strategy on ambient air quality.

Noting the projected increases in pollutant emissions caused by the anticipated population growth in the North and South Central Coast Air Basins, the State Air Resources Board has concluded that national ambient air quality standards will be maintained by the implementation of the State's emission control strategy. A summary of the present and projected ambient air quality for the North and South Central Coast Air Basins is presented in Table 11-7.

In order to meet the ambient air quality levels projected for 1980, noted in Table 11-7, the State Air Resources Board has stipulated that many significant measures to control contaminant emissions must be implemented. The State's strategy actions follow; applicable ones will be implemented in the North and South Central Coast Air Basins. (1) continuation of the State's current motor vehicle emission control program, (2) elimination of carbon monoxide emissions from aircraft and ships, (3) periodic inspection of vehicles emitting gaseous fuel, (4) reduction of motor vehicle use through use of public transportation, (5) car pooling and changes in work schedules, (6) control of the evaporative emission of organic materials, (7) regulation of the use and disposal of organic solvents, and (8) the retrofit control of the fuel evaporative emissions from 1966 through 1969 model motor vehicles.

The construction of wastewater treatment facilities has the secondary potential of allowing population growth and thereby aggravating air quality in problem areas. As a result, the State Water Resources Control Board will financially participate in only 5-year capacity increments for the expansion of present facilities in "critical" air areas. Municipalities in the critical air areas may construct larger capacity increments by absorbing the total cost over the 5-year capacity cost.

Critical air regions center on the two major metropolitan areas of California, San Francisco Bay and the Los Angeles lowlands. The Central Coastal Water Quality Control Basin extends into the San Francisco Bay Area Air Basin on the North and the South Coast (Los Angeles) Air Basin on the south. As sparsely settled areas of the larger air basins, these two portions are relatively small contributors to the critical air problems.

Oceanography

The ocean area adjacent to the basin extends south from Pescadero Point in southern San Mateo County to Rincon Point south of Santa Barbara, including the waters surrounding San Miguel, Santa Rosa and Santa Cruz islands.

The Pacific Ocean off the coast of central

Table 11-7. North and South Central Coast Air Basin Ambient Air Quality[a]

Contaminant	National standard	1970 level		1980 projected level	
		South	North	South	North
Carbon monoxide, ppm	9[b]	7	6	9	< 9
Nitrogen dioxide, ppm	0.05[c]	0.023	0.024	0.05	< 0.05
Oxidants, ppm	0.08[d]	0.12	0.11	0.08	< 0.08
Particulate matter, mg/m^3	60[e]	42	37	60	< 60
Sulfur dioxide, ppm	0.02[c]	f	f	0.02	< 0.02

[a] Source: The State of California Implementation Plan for Achieving and Maintaining the National Ambient Air Quality Standards, Air Resources Board, 1972.

[b] 8-hour average

[c] Annual average

[d] 1-hour average

[e] Annual geometric mean

[f] Contaminant level not monitored.

California north of Point Conception has two basic oceanographic seasons: (1) the warm season when the southerly California Current is the prevailing nearshore current; and (2) the rainy season when the northerly Davidson Current lies along the coast inshore of the California Current. The dry season current regime may be divided further into two periods: (a) the period of upwelling of late spring and summer; and (b) the oceanic period during the clear hot weather of the late summer-fall.[8] The dry season includes spring and summer; the wet seasons begins in mid November and usually lasts until mid February.

During the dry season period of upwelling, the surface water of the California Current is driven seaward by relatively strong, persistent northwesterly winds and is replaced by an upwelling of cool, nutrient-rich subsurface water. Upwelling alters the density distribution in the water column and is responsible for relatively low water temperatures locally along the coast. Toward the end of summer the upwelling gradually ceases, and a more regular pattern of current returns. Water temperatures along the coast rise and density structures stabilize. Fig. 11- 10 illustrates the seasonal current patterns for the southern portion of the Central Coastal Basin.

Water masses along the west coast of the United States come from the north Pacific and are carried to the California shelf by the California Current. Flowing southward, this water is modified through addition from river discharges and through upwelling of deeper waters along the coast.[9]

The California Current generally follows parallel to the direction of the edge of the continental shelf and remains outside the channel islands south of Point Conception. Within the Santa Barbara channel, current flow is characterized by a counter-clockwise movement in the western half of the channel and a northwesterly flowing current in the eastern part of the channel. Convergence of these currents in the area between Santa Barbara on the main coast and Santa Cruz Island results in a complex pattern of eddies.[10]

Though the California Current and resulting countercurrent center in the Santa Barbara Channel, they rarely carry water over the shelf at appreciable velocity, but they are the basis of physical oceanographic conditions in the area.[9]

Current patterns within Monterey Bay are complex. The ocean current and wind patterns, generally prevailing from the northwest, create a waste disposal problem by holding bay waters in a lake-like condition, rather than permitting a rapid transport of waters offshore or southerly as is usual along the coast. Monterey Canyon greatly affects Monterey Bay current patterns by upwelling, which brings nutrient enrichment to the bay. Throughout the year, a large eddy, usually with clockwise, but occasionally counterclockwise circulation, depending on a complex set of conditions, is set up in the southern part of the bay and usually a counterclockwise circulation occurs in the northern part of the bay.[11]

Investigation and development of oceanographic information are necessary in a water quality management study for determining the suitability of proposed ocean disposal sites. Physical oceanographic conditions such as water temperature, dissolved oxygen, pH, salinity and ocean currents in areas of interest must be examined as part of the engineering design of ocean outfalls and to determine the probable impact of waste discharges upon biological communities.

A substantial amount of data has been collected on temperature, salinity density and other marine conditions in the Northern Central Coastal Basin as part of the AMBAG oceanographic studies.

Data pertaining to the oceanographic area off the southern portion of the Central Coastal Basin is divided into three geographical areas as illustrated in Fig. 11-11.

Averages of temperature profiles for the three areas representative of the three seasonal periods described previously are shown in Fig. 11-12. In each case water temperatures north of Point Conception are markedly cooler than those for waters south of Point Conception, reflecting the presence of the counter-current of the Santa Barbara Channel bringing warmer water from the south.[12]

Over the shelf south and east of Point Conception, the surface in summer warms to a temperature 10 to 15 F above the temperature at 200 feet of depth, resulting in a stable density structure. In winter, stability is less, and occasionally high winds will produce a condition of almost complete mixing in waters less than 200 feet deep.

Density profiles for the three areas during the various seasonal periods are shown in Fig. 11-13. These profiles show a general increase in density at 200 feet during the upwelling period associated

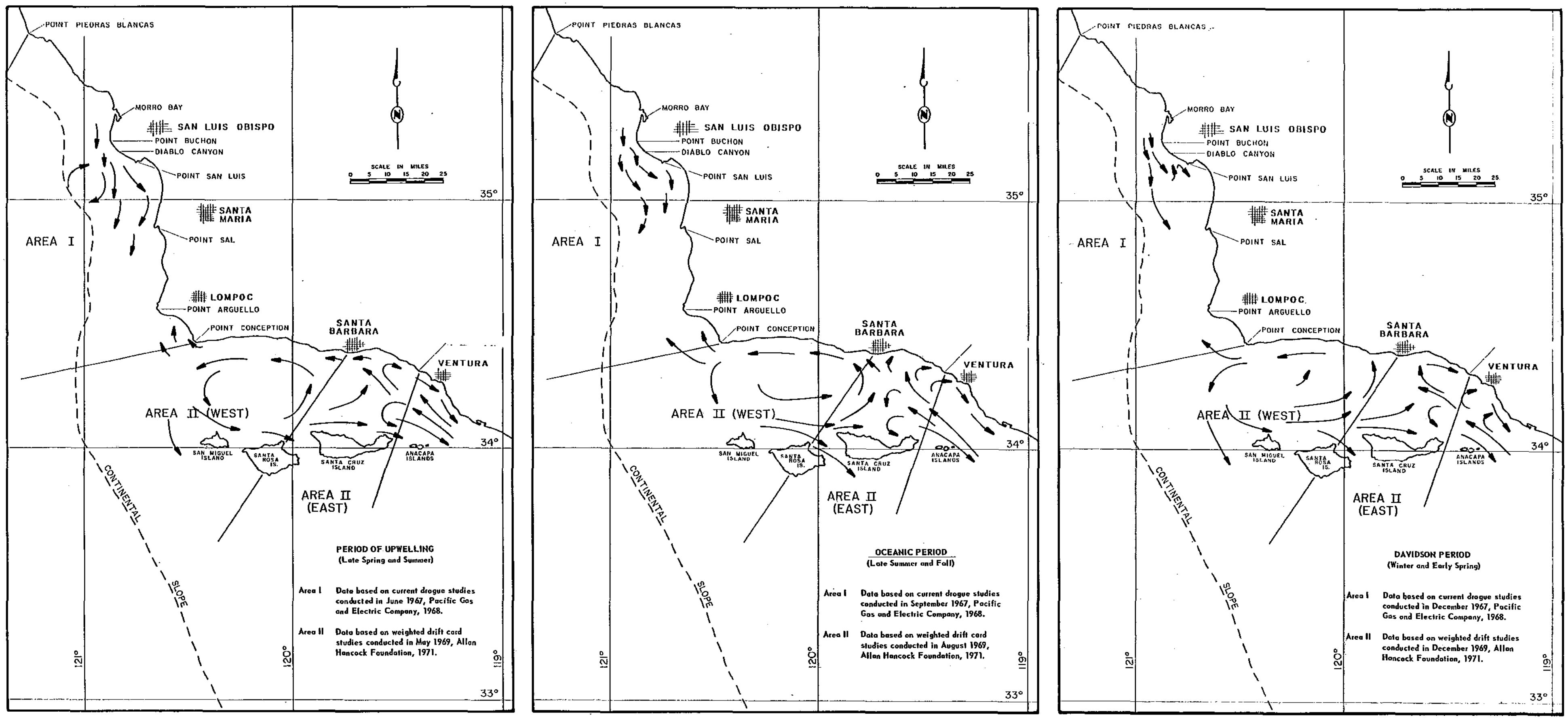

Fig. 11-10 Southern Central Coastal Basin Seasonal Ocean Currents

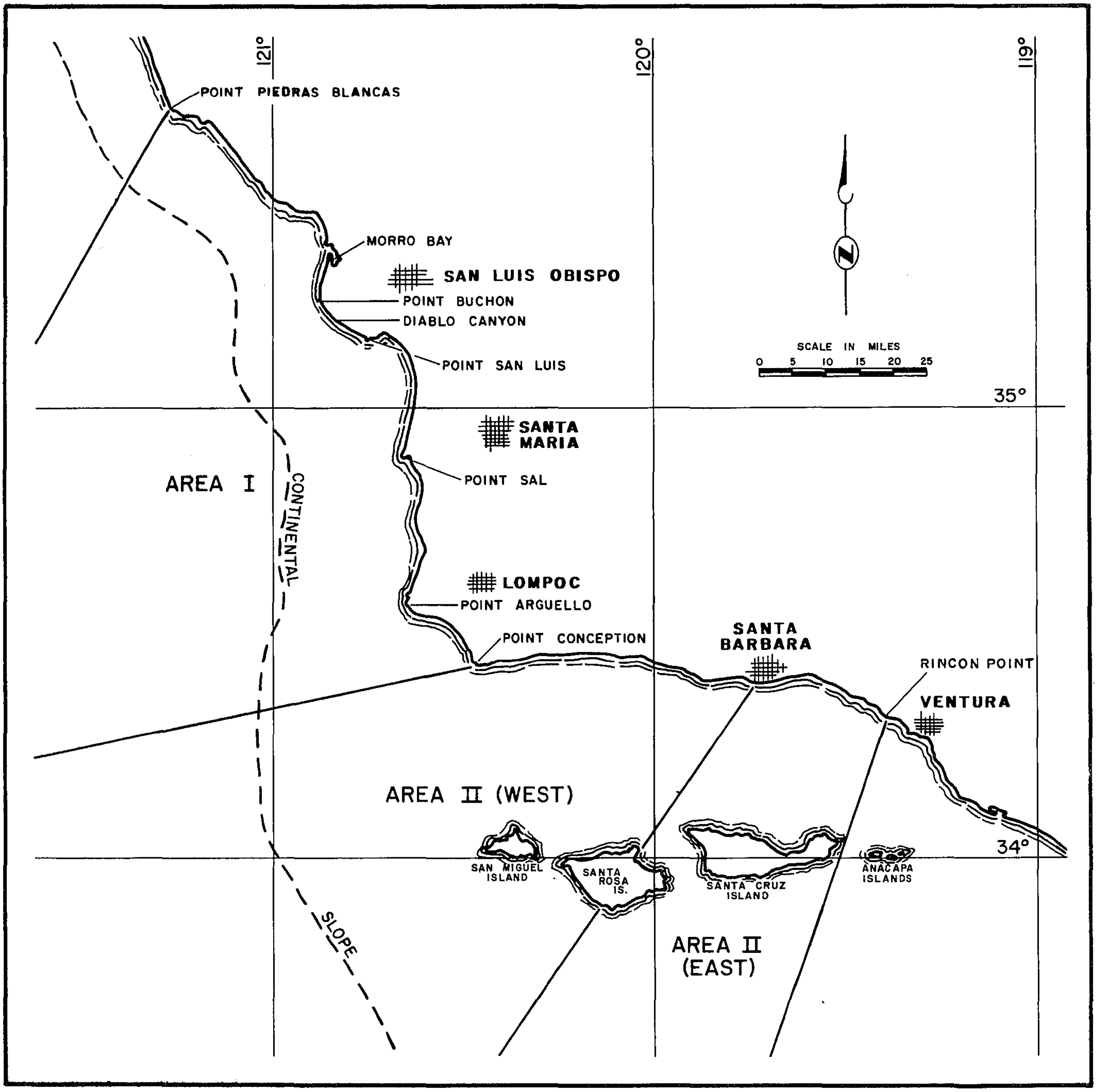

Fig. 11-11 Subdivisions of the Southern Central Coastal Basin Shoreline

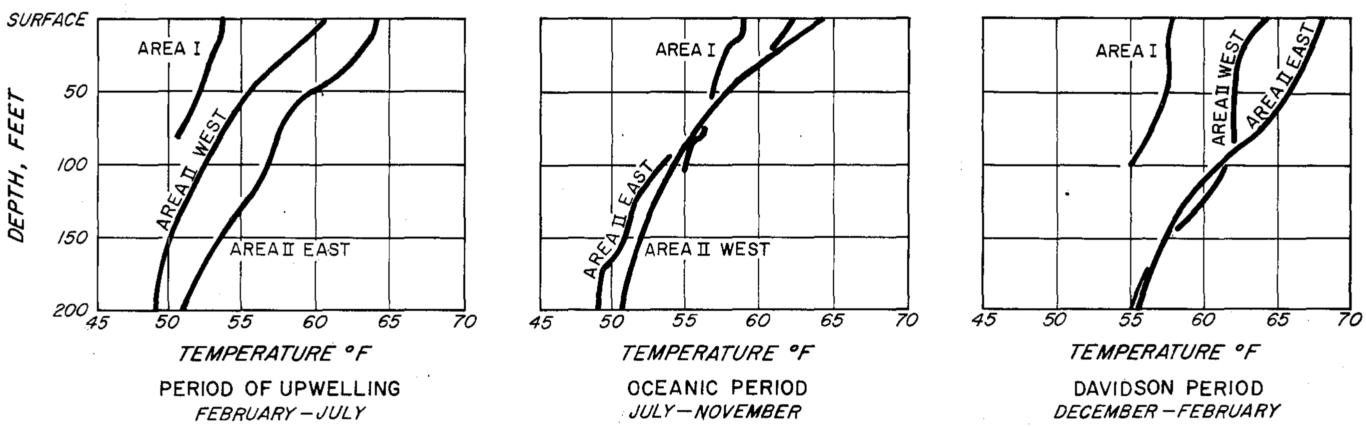

Fig. 11-12 Southern Central Coastal Basin Ocean Temperature Profiles.

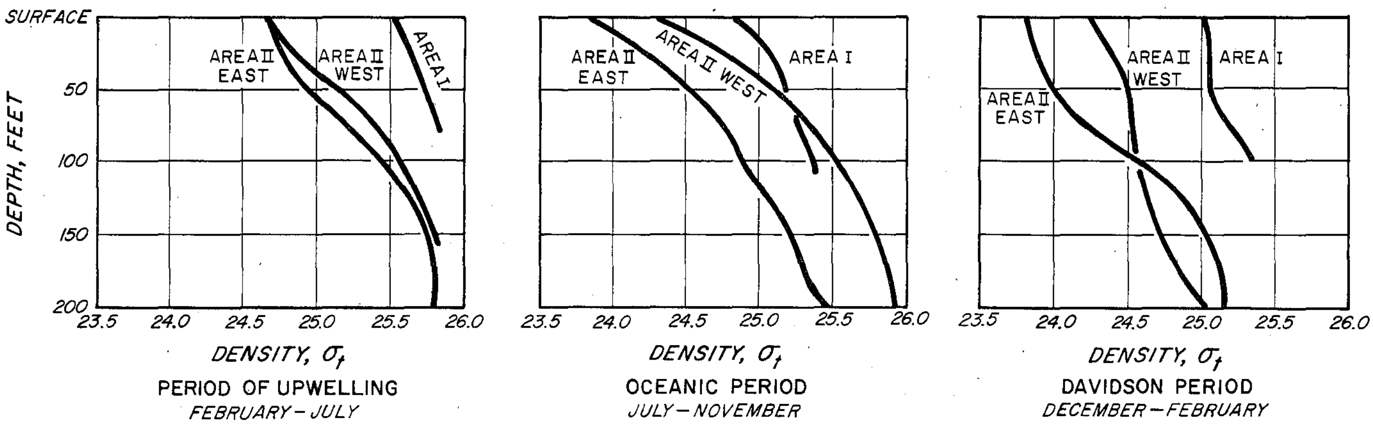

Fig. 11-13 Southern Central Coastal Basin Ocean Density Profiles

with the lower subsurface temperatures during that time and the presence of a large vertical gradient of density. Surface densities appear lowest during the oceanic period mostly because of the increase in temperature during that period. During the Davidson Current period, surface densities increase and those at 200 feet decrease.[13]

Salinity generally increases with depth from the surface, but the range, typically between 33.50 and 33.75 parts per thousand, is not large.[14] Physical oceanographic data for the area north of Point Conception are sparse and data on chemical properties are almost non existent.

South of Point Conception, concentrations of dissolved oxygen at the surface have been found to reach 140 percent of saturation, presumably as a result of photosynthesis. There is a normal decline with depth, but in no period is the average oxygen at 200 feet less than 4.0 mg/l or about 50 percent of saturation. Upwelled waters from greater depths are therefore characterized by lower oxygen concentrations. In general, surface water nutrient values appear to be highest in May and lowest in December.[10]

Values for pH range from a minimum of 7.5 to a maximum of 8.6 with an average of 8.5. Most of the determinations between 7.6 and 7.8 were from samples obtained at the 200 to 300 foot levels.

Fish and Wildlife Resources

The ecological systems which support the fisheries and wildlife resources of the southern Central Coastal Basin are a significant component of the total environment. This section summarizes very briefly what is currently known regarding the ecological systems of the basin which are most likely to be affected by water quality and quantity and its management.

This investigation was divided for the two major study areas: the AMBAG area and the southern portion of the Central Coastal Basin. Some of the following discussions are consolidated, but the slightly different methods in approach and organization of results require separate treatment for some topics.

Habitat Occurrence

A key to understanding the biological systems of any geographic area is the range of habitat types present. Many species of the flora and fauna are restricted to a certain type of habitat. Loss of that habitat will result in elimination of the species dependent upon it. However, in many cases there may be overlap; that is, a species may occur in more than one habitat type. An example of this is the estuarine habitat where the fauna includes both marine and freshwater species.

Frequenty, a species requires different habitats at different stages of its life history. In that case, elimination or degradation of any one of the needed habitats will result in the loss of the species. An example of this latter case is the steelhead trout. Although the adults live primarily in the ocean, degradation of the fresh water streams in which they spawn, to the point that a barrier to migration is imposed, would result in their elimination.

The Central Coast Basin contains a variety of habitat types. These habitat types are primarily responsible for determining which plant and animal species are likely to occur at a particular geographic location. Since a knowledge of the species present in an area is necessary in order to determine its environmental sensitivity, a general description of the biota of the various habitats is presented.

Eleven broad habitat types have been identified in the AMBAG area and they are described in Table 11-8. Table 11-9 summarizes the occurrence of the habitat types found in the AMBAG subbasins. A generalized habitat map of the southern portion of the Central Coastal Basin is given in Fig. 11-14 and a discussion of the habitats identified in the figure follows. Although both methods greatly simplify the representation of the actual situation, they nevertheless demonstrate the tremendous habitat diversity within the basin.

Coniferous Forest

This classification includes redwood forest, closed cone pine coastal forest, and scattered ponderosa pine forest. Wildlife value ranges from low in the redwood forest to moderate in the pine forest. The latter supports fur bearers, coyotes, bobcats, gray fox, beaver and others. Songbirds are also abundant in the summer. Upland game of the pine forests include band-tailed pigeons, blue grouse, California and mountain quail.

Hardwood and Riparian Woodland

Hardwood forest consists of broadleaf trees such

Table 11-8. AMBAG Habitat Type Description Summary

Habitat	Key features	Examples of species
Nearshore zone	Marine environment from lowest low tide to edge of continental shelf, including offshore coastal rocks	Algae, kelp, albacore, bottomfish, crab, seals, whales
Tidal zone	Aquatic environment affected by tidal action from edge of near-shore to the limit of the highest high tide, including subtidal areas of bays, estuaries and sloughs. Important nursery area.	Clams, crabs, rockfish, shorebirds, waterfowl
Marshes	Saltwater, freshwater, or brackish shallow water areas either vegetated throughout or with patches of open water. Can be permanent or seasonal.	Saltgrass, pickleweed, waterfowl, wading birds
Coastal strand	Narrow strip of sand flats and dunes along the coast	Grasses, succulent plants
Freshwater	All freshwater streams, rivers, lakes, and reservoirs. Most animals are dependent upon freshwater to some degree.	Algae, salmon, steelhead, bass
Cultivated pasture	Includes irrigated and non-irrigated cropland and developed grazing lands (pasture). Supplemental food for waterfowl.	Vineyards, clover, waterfowl, mourning doves, herons
Grassland	Open grass range, including undeveloped grazing lands. Relatively low value to wildlife except in "edge" areas.	Grasses and forbs, mice, rabbits, hawks, eagles
Chaparral-scrub	Bushy slopes dominated by woody plants generally less than six feet tall	Manzanita, ceanothus, scrub oak, scrub jays, deer
Coniferous forest	Stands of large evergreen trees. Wildlife densities quite variable.	Redwood, Douglas fir, quail, deer, bear
Woodland (including riparian)	Stands of deciduous trees. Includes streamside growth (riparian) of high value to wildlife.	Oak, buckeye, cottonwood, willows, songbirds, quail, deer, bear
Urban and industrial	Includes all cities, suburbs, industrial parks, and all roads and freeways. Moderate to low value for wildlife.	Songbirds, mice, raccoons

Table 11-9. Habitat Types Found in AMBAG Sub-basins

Sub-basin	Habitat types										
	Nearshore zone	Tidal zone	Marshes	Coastal strand	Freshwater	Cultivated pasture	Grassland	Chaparral scrub	Coniferous forest	Woodland	Urban and industrial
Santa Cruz Coastal	X	X		X	X	X		X	X		
San Lorenzo	X	X		X	X				X		X
Aptos-Soquel	X	X		X	X				X		X
Pajaro	X	X	X	X	X	X	X	X	X	X	X
Salinas	X	X	X	X	X	X	X	X	X	X	X
Carmel	X	X	X	X	X	X	X	X	X	X	X
Monterey Coastal	X	X		X	X			X	X		

as the live oak. Riparian woodlands are confined to stream banks. Predominant vegetative elements are willow, cottonwood, oak and wild grape. Pure oak forests support large populations of gray squirrels and band-tailed pigeons, quail and deer are also abundant. Riparian woodland provides food and cover for a great variety and abundance of game and non-game species and is considered to be one of the most valuable of all wildlife habitats. Intermediate habitats such as woodland-chaparral and woodland-grass are also recognized. Designations on the habitat map are dependent upon which feature predominates.

Juniper-Pinon Pine

This is open forest dominated by juniper or pinon pine. Shrub species such as bitter brush, sage brush and rabbit brush and ground covers such as cheat grass commonly occur. Wildlife value is good, particularly as a winter range for deer. Upland game species include quail, chukars, doves and band-tailed pigeons, which feed extensively on pinon nuts. Coyotes and bobcats are the most common fur bearers.

Northern Desert Scrub

Characteristic vegetation consists of sage brush, salt bush, mountain mahogany and bitter brush, with an understory of wheat grass, cheat grass, peas and fescues. Most of these plants are alkaline tolerant. Wildlife value is high, particularly around streams and springs. This habitat type provides important winter range for mule deer. Other upland game species include jackrabbits, cottontails, quail, doves and chukars. Fur bearers such as coyotes and bobcats are common. Golden eagles are also seen occasionally.

Southern Desert Scrub

The characteristic vegetation of this hotter, drier habitat type consists of alkali tolerant plants such as salt bush, creosote, rabbit brush and mesquite associated with various cacti, yuccas, bursage, and galleta. Cottonwoods, willows, desert apricot, palo verde and other hardwood trees occur along many of the water courses. It is moderately good upland game habitat, particularly in those areas where groundwater is available. For the purposes of this report, northern and southern desert scrub were combined under one classification: desert scrub.

Chaparral

This habitat is characterized by solid brush stands consisting of a great variety of species. The dominant shrub on warmer, south facing slopes is chamise. In other areas, the composition is quite heterogeneous. This classification also includes coastal sage brush. Both sage brush and new growths of chaparral provide good cover for quail, rabbits, deer and fur bearers. Nongame birds and mammals are also abundant.

Grassland

Grasslands consist primarily of annual grasses such as wild oats, brome grasses, annual fescues which have been introduced by man and associated forbs such as clovers and filaree. Extensive open grasslands have a relatively low habitat value. However, areas adjacent to different habitat types become highly valuable as wildlife feeding areas.

Cultivated Land and Pasture

This includes all irrigated and non-irrigated crop lands, orchards, and pastureland. Many wildlife species such as deer and quail which are common to adjacent habitats utilize these areas for feeding. Waterfowl also feed extensively on cereal crops and irrigated pastures. Irrigation ditch systems provide cover, food and water in areas which otherwise would be too dry to support wildlife.

Urban and Industrial

These are areas where the natural vegetation has been displaced by construction of cities, towns, and industries. Military installations are also included. Various park areas contain animal species which frequent nearby natural habitats. Songbirds are also common in park and residential areas.

Barren

The barren areas shown on the map are those with a vegetative cover of less than 20 percent. Those plants which do occur are primarily succulents and woody perennials which grow prostrate to the ground. The habitat includes massive rock outcrops as well as expanses of sand dunes adjacent to beaches. Generally, few animal species are present except for incidental visitors from other habitats. An exception to this generalization is found in that area of sand dunes at the south end of Morro Bay. These sand dunes are the exclusive habitat of the Morro Bay kangaroo rat, an endangered species.

Freshwater Streams and Reservoirs

Existing freshwater habitat of the Central Coast Basin can be divided into two broad categories: coldwater habitat and warmwater habitat. Coldwater habitat includes both streams and lakes or reservoirs with temperatures low enough to accomodate salmonid fish. Few lakes or reservoirs of the basin have adequately low seasonal temperatures for natural trout propagation. Consequently, most lakes listed as coldwater habitat are stocked with catchable trout by the Department of Fish and Game.

Warmwater habitat includes streams, lakes and reservoirs which become too warm for salmonids during the summer months. However, they do support various warmwater fish species.

Many of the waters of the basin do not fit perfectly into either of these categories; and, in fact, many gradations exist between the two extremes. These intermediate waters are sometimes termed mixed because both warm and cold water species are present.

Freshwater invertebrate fauna include the immature aquatic stages of insects such as mayflies, stoneflies and caddis flies. These organisms are very important as a source of food for freshwater fish.

In the South Central Coast Basin, steelhead trout are the only anadromous fish which continue to enter freshwater streams to spawn. Resident or stocked catchable coldwater fish of streams and lakes are primarily rainbow trout and brown trout. Warmwater game species of streams and reservoirs include the largemouth and smallmouth bass, sunfishes and crappie. Most of the nongame species present are various species of suckers and minnows.

The value of reservoirs to wildlife, particularly waterfowl, is decreased when continuous water level fluctuations prevent the growth of most aquatic plants and shore vegetation. However, they do serve as sources for drinking water for birds and mammals and as resting grounds for migratory waterfowl. Releases of water during the dry summer and autumn months also serve to support downstream riparian habitat and its associated wildlife downstream of Gibraltar and Cachuma Reservoirs, for example.

Marshlands

Marshlands, both freshwater and saltwater, are found scattered along the entire coast and at a limited number of inland locations. Water depths are generally shallow, a factor which favors extensive growth of aquatic plants. Those marshes fed by freshwater streams and rivers are characterized by the presence of tules, cattails, California bulrush, spike weed, pondweeds and sedges. Pickleweed, salt grass, cord grass and eel grass are the common plants of salt marshes.

The value of marshlands to wildlife is extremely high. They contain some of the most critical waterfowl and shorebird nesting and wintering areas in the state. The California clapper rail, an endangered species, is strictly dependent on cord grass marsh. This habitat type has become exceedingly scarce due to previous losses of wetlands to development. For this reason, currently existing marshes should be protected. Marsh plants, such as cord grass, appear to serve an important role in the overall ecology of the marsh due to their high productivity. As they decompose, they are believed to serve as a key detritus food source for filter feeding organisms, thus providing a base for the food chain.

Some juvenile fish species are believed to utilize salt marshes extensively for shelter and feeding grounds during early stages of their life cycle. Many other species of fish and birdlife prey on insects, polychaetes and molluscs which are also present.

Mammals, which are known to occur in marshes, include the river otter, beaver, mink, muskrat, jackrabbit, striped skunk, and raccoon.

Tidelands

Tidelands include the portion of the coastal shoreline which lies between the level of the lowest low tides and the highest high tides. There is considerable variation in the composition of the intertidal flora and fauna depending upon the type of substrate, the degree of wave exposure, and the salinity of the water.

The intertidal zone along exposed sandy beaches supports several species of marine invertebrates including beach hoppers, sand fleas, shore and sand crabs, cockles, bent-nosed and pismo clams, sand dollars and shrimp. Several shorebirds feed on these animals.

The rocky intertidal coast is characterized by the presence of a great diversity of marine invertebrate and plant species. Four zones are commonly

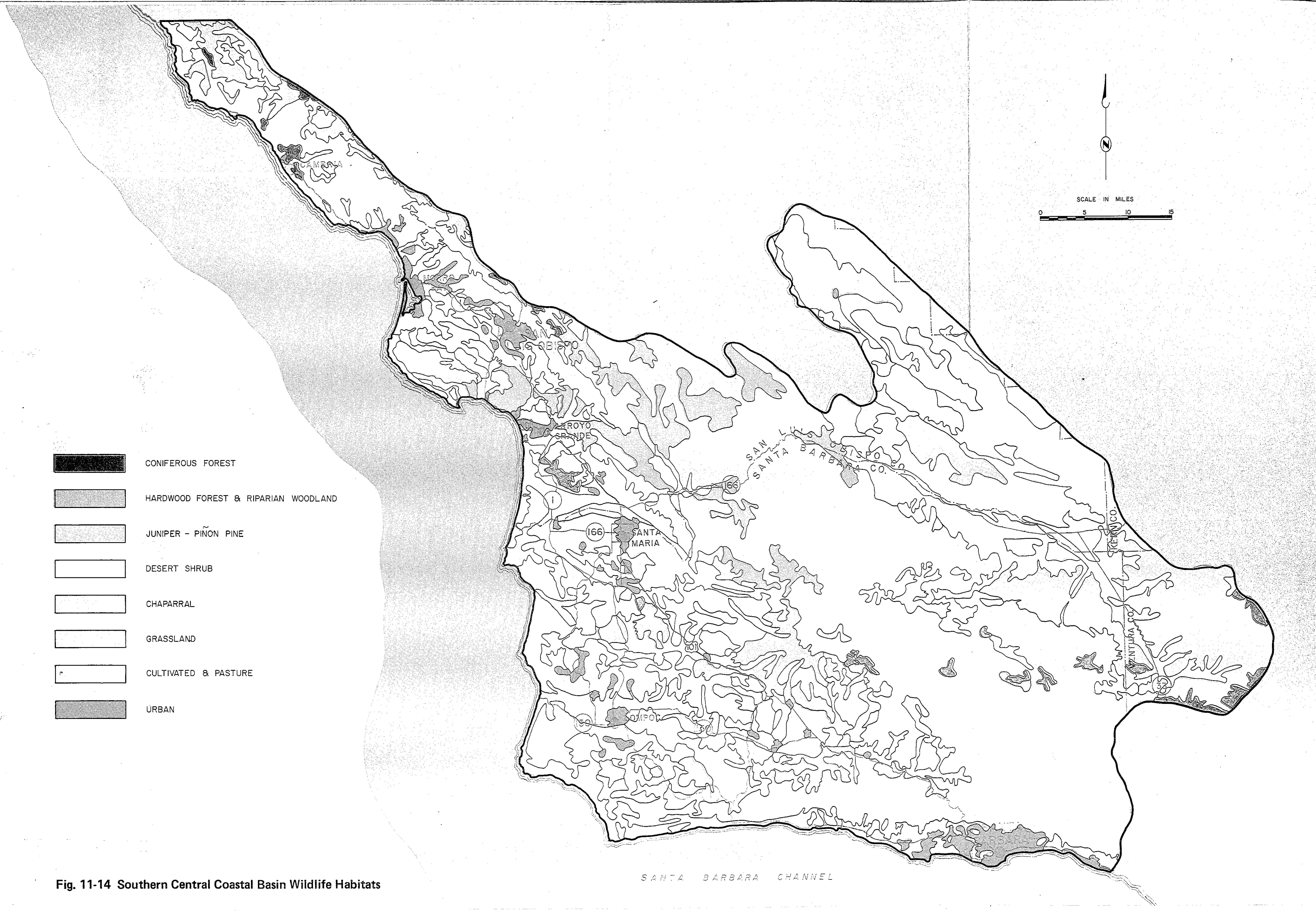

Fig. 11-14 Southern Central Coastal Basin Wildlife Habitats

recognized between the extremes of high and low water: the splash zone, the high tide zone, the middle tide zone and the low tide zone. Each of these zones is populated by its own unique biotic assemblage. Intertidal plants consist of various species of red, brown and green algae. Common animals include the barnacles, limpets, turban snails, hermit crabs, shore crabs, anemones, abalone, lobster and urchins. Intertidal mudflats, within protected bays and estuaries such as Morro Bay, are very important biologically. Photosynthetic diatoms occur there in enormous numbers and form a golden-brown coating on the surface of the mud. Although the productivity of these microscopic plants has not been well studied, it is believed that they play an important role at the base of the food chain by providing grazing for molluscs and other mudflat invertebrates.

The mudflats also support a rich invertebrate fauna consisting of various clams, mussels, snails, polychaete worms, crustaceans and many other species. As such, they are important as feeding areas for many species of aquatic birds. Stomach analyses have shown that molluscs (small clams, mussels, and snails) constitute the bulk of the diet of shorebirds and diving ducks in the coastal wetlands of California. The balance of their diet consists of crustaceans, polychaete worms and miscellaneous insects.

The millions of migratory shorebirds and waterfowl which utilize the Pacific Coast Flyway depend upon finding adequate supplies of these invertebrates in Pacific Coast bays and estuaries such as Morro Bay and Goleta Slough. Intertidal mudflats may also be important feeding grounds for juvenile forage and game fish and crustaceans.

Nearshore Marine Habitats

The marine habitat may be divided into neritic and benthic communities. Neritic biota are the free swimming or suspended flora and fauna which comprise the phytoplankton, zooplankton and nekton. Benthic biota are the sessile or bottom dwelling organisms which consist essentially of attached algae and the zoobenthos.

The areas of greatest concern in the marine environment are the kelp beds and other resources of commercial importance. Commercially important resources are discussed in detail later.

The term kelp bed is applied only to those areas having a surface canopy of kelp. These beds provide habitat for large numbers of marine organisms. Together these plant and animal species comprise a complete and interdependent biotic community. Many invertebrates, including abalone, feed directly on the attached algae. They are, in turn, fed upon by animals higher in the food chain.

Fish Resources

Additional consideration is given to fish resources within the basin. Table 11-10 indicates the importance of the marine environment as it lists the annual commercial landings by species while Table 11-11 summarizes the relative value of the streams for steelhead reproduction habitat.

SUB-BASIN HYDROLOGICAL CHARACTERISTICS

Because the hydrological characteristics of the basin vary considerably from one sub-basin to the next, the following sections present those characteristics for each sub-basin. The location and topography of each of the sub-basins are briefly described and the surface water and groundwater hydrology of each is discussed.

Santa Cruz Coastal Sub-Basin (01)

The Santa Cruz Coastal Sub-basin includes a number of small coastal drainages northwest of Santa Cruz to Pescadero Point. The largest and most northerly is Butano Creek. The sub-basin is bounded on the north by the Butano Creek - Pescadero Creek drainage divide, and on the east by the drainage divide of the San Lorenzo River. The sub-basin includes an area of approximately 149 square miles.

The headwaters of the creeks making up this sub-basin are located in steep and heavily forested mountains. Several state parks within the sub-basin protect virgin redwood groves. Along the coast, the mountains are separated from sandy beaches by a sloping marine terrace with an average width of approximately one-half mile.

Surface Water Hydrology

It is estimated that mean surface runoff from the sub-basin to the Pacific Ocean is on the order of 115,000 acre-feet. Under present conditions, municipal, industrial and agricultural water use within the sub-basin is less than 5000 acre-feet

Table 11-10. Major Steelhead Trout Streams

Stream	Number of miles used by steelhead (from mouth of stream)
San Carpoforo Creek	4
Arroyo de la Cruz	22
Little Pico Creek	5
Pico Creek	10
San Simeon Creek	30
Santa Rosa Creek	27
Villa Creek	16
Cayucos Creek	6
Toro Creek	6
Morro Creek	21
Chorro Creek	25
Los Osos Creek	8
San Luis Obispo Creek	39
Pismo Creek	18

per year. Projected use in the year 2000 is on the order of 9000 acre-feet per year.

Groundwater Hydrology

There are several small groundwater basins located along the coastal terraces which are recharged by direct rainfall; the principal basin is identified as the West Santa Cruz Terrace. The yield of these basins is very limited, however, and safe yield of all groundwater basins within the sub-basin is estimated to be about 6000 acre-feet.

The perennial yield of the water-bearing deposits of groundwater supply is the rate at which water can be pumped from wells year after year without decreasing the storage to the point where the rate becomes economically infeasible, the rate becomes physically impossible to maintain, or the rate causes the landward migration of sea water into the deposits and thus renders the water chemically unfit for use. It may be feasible in some basins to pump quantities in excess of the perennial safe yield for several years if this can be followed by pumping less than the perennial safe yield to allow the basin to recover.

Future Use and Development

The Santa Cruz County Flood Control and Water Conservation District Master Plan for Water Development has proposed surface water development within the sub-basin around 1990 which would provide approximately 11,700 acre-feet for municipal supply to the area from Davenport to Santa Cruz. The proposal involves a reservoir on Scott Creek and diversions from San Vicente, Laguna and Majors Creeks and Liddell Springs.[15]

San Lorenzo River Sub-Basin (02)

The San Lorenzo River Sub-basin covers an area of approximately 140 square miles within Santa Cruz County, bounded on the north by Pescadero Creek and Stevens Creek drainage divides, which are generally represented by portions of the southern boundaries of San Mateo and Santa Clara Counties. The area extends south to Monterey Bay and is bounded on the west by Ben Lomond Mountain and on the east by the Santa Cruz Mountains.

The San Lorenzo River flows generally south-southeast in a narrow valley which is highly developed. The towns of Boulder Creek, Ben Lomond and Felton lie along the narrow seven square mile valley. Tributaries include Boulder Creek from the west and Kings, Bear, Newell, Lompico, Zayante, Bean and Branciforte creeks from the east. Most of the sub-basin area is rugged mountainous terrain which is densely forested. Maximum elevation in the sub-basin is approximately 3200 feet.

Surface Water Hydrology

Data on monthly surface runoff for San Lorenzo River at Big Trees is given in Table 11-12. For median conditions, approximately 60 percent of the flow occurs in the three months January through March. As can be seen from Table 11-12, less than 15 percent of the median annual flow occurs in the six month period June through November. Median annual discharge for San Lorenzo River at Big Trees is 65,650 acre-feet.

Ground Water Hydrology

Groundwater basins within the San Lorenzo Sub-basin consist of terrace deposits of limited thickness and small areal extent, consisting of gravel, sand and silt. Along the San Lorenzo River, continental deposits occur from Richgrove to Felton. Marine terraces occur along the coast in the vicinity of Santa Cruz. Total safe yield of groundwater deposits within the San Lorenzo Sub-basin is estimated at 2500 acre-feet per year.

Aptos-Soquel Creeks Sub-Basin (03)

The Aptos-Soquel Creeks Sub-basin lies entirely within Santa Cruz County and extends south from the Santa Cruz-Santa Clara County boundary to Monterey Bay. The sub-basin lies between the San Lorenzo River Sub-basin on the west and the Pajaro River Sub-basin on the east. The western boundary is formed by the drainage divide of Bean and Branciforte Creeks in the San Lorenzo River Sub-basin and Soquel Creek. The eastern boundary is formed by the divide between Corralitos Creek drainage to the Pajaro River Basin and Aptos Creek.

The Aptos-Soquel Creeks Sub-basin contains rugged mountains in the north, grading to rolling hills and well developed marine terraces along the coast. The terraces are abruptly terminated along the coast line by high sea cliffs. Total area of the sub-basin is about 77 square miles.

The principal groundwater basin within the area underlies the Soquel Valley. The basin comprises an area of about five square miles and consists of thin deposits of late alluvial silts, sands and

Table 11-11. Marine Fin Fish Resources

Type of fish	Status of resource
Pacific sardine	Present moratorium on raking stipulates that they may constitute no more than 15 percent (by weight) of total catch. Population was severely overharvested in the past but slow recovery is anticipated.
Jack mackerel	Taken inshore and offshore. Fishery has recently expanded greatly. Second in overall catch size during 1969.
Pacific mackerel	Taken inshore, overharvested.
Albacore	Offshore fish taken commercially and for sport. Sensitive to pollution from the mainland.
Northern anchovy	Very abundant. Accounted for more than two thirds of total commercial catch in 1969. Taken inshore with highest recoveries coming from area south of Point San Luis. Utilized primarily for reduction purposes.
Rockfishes	Bottom fish. Very stable fishery consisting of 17 species. Trawled offshore and caught by hook and line inshore.
Pacific bonito	Fishery has increased in last 10 years.
Flatfishes	Petrale, English and rex sole, California halibut. Primarily inshore, bottom dwelling fish. Valued as sport and market fish.
Bluefin tuna	Highly variable fishery depending on ocean water temperatures. Rarely taken in this area.
Pacific salmon	Includes both chinook and coho salmon. Highly valued commercially and as sport fish. They are close to the southern limit of their distribution and most originate from Northern California and Oregon streams. Catches fluctuate widely, depending on ocean temperatures. Taken inshore particularly in San Luis Obispo Bay. Chiefly threatened by loss of freshwater spawning grounds.
Other species	Sharks, barracuda, flounders, lingcod, swordfish, and surfperches are of relatively minor importance.

Source: Best, E. A. and Malcolm S. Oliphant, Report on Evaluation of Fish Resources of the Point Arguello Area, Part II, Marine Resources of the Point Arguello Area, Prepared for the Bureau Commercial Fisheries, July, 1965. (updated)

Table 11-12. Monthly Variation of Surface Runoff in San Lorenzo River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Dry (1960-61) in acre-feet	812	2,000	2,370	1,990	2,520	3,290	1,770	1,310	964	591	521	526	18,660
Wet (1940-41) in acre-feet	1,300	1,420	17,260	45,790	74,010	43,950	56,040	11,410	5,570	3,510	2,570	2,050	264,900
Median[b] in acre-feet	1,340	1,750	4,590	11,250	15,000	14,330	6,540	4,400	2,560	1,550	1,260	1,080	65,650[c]
As percent of annual runoff	2.0	2.7	7.0	17.1	22.9	21.8	10.0	6.7	3.9	2.4	1.9	1.6	100

[a] San Lorenzo River at Big Trees. Drainage area - 111 square miles. Period of record - October, 1936 to present.

[b] Median discharge from 1936 to 1970 (35 years).

[c] Sum of monthly medians.

Table 11-13. Monthly Variation of Surface Runoff in Pajaro River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Dry (1947-48) in acre-feet	254	393	532	654	580	1,040	1,980	1,520	210	44	23	24	7,250
Wet (1940-41) in acre-feet	628	831	10,380	49,460	137,400	121,900	107,400	13,180	2,190	1,120	976	819	446,300
Median[b] in acre-feet	254	536	1,380	5,740	13,500	7,380	2,640	1,300	477	274	286	167	33,980[c]
As percent of annual runoff	0.8	1.6	4.1	17.0	39.7	21.7	7.8	3.8	1.4	0.8	0.8	0.5	100

[a] Pajaro River at Chrittenden. Drainage area - 1,186 square miles. Period of record - October, 1939 to present.

[b] Median discharge from 1940 to 1970 (31 years).

[c] Sum of monthly medians.

gravels underlain by relatively permeable marine sediments. Throughout the valley fill area, extensive strata of impermeable "shell rock" several feet thick serve to confine the groundwater. Maximum thickness of the aquifers is 60 feet. Most of the Soquel Creek drainage basin serves as the forebay for the confined aquifer. Estimated groundwater safe yield in the Aptos-Soquel Sub-basin is 7400 acre-ft/year.

Pajaro River Sub-Basin (04)

The Pajaro River Sub-basin consists of a long narrow northwest trending interior valley which drains through Pajaro Gap to a coastal plain fronting on Monterey Bay. Total area of the sub-basin is approximately 1302 square miles. The narrow interior valley is structurally continuous with the Santa Clara Valley. On the east, the interior valley is bounded by the Diablo Range and on the west, south of Pajaro Gap, it is separated from the Salinas River Sub-basin by the Gabilan Range. The southern portion of the interior valley is drained by the San Benito River which flows northwest to join the Pajaro River just upstream from Pajaro Gap. The San Andreas Fault runs along the west side of the San Benito Valley.

North of Pajaro Gap, the interior valley is separated from the coastal portion of the Pajaro River Sub-basin by the Santa Cruz Mountains. The northern interior valley is separated from the San Francisco Bay Basin at its northern end by a low topographic divide which is formed by the alluvial fan of Coyote Creek. Coyote Creek drains a portion of the Diablo Range and enters the Santa Clara Valley from the east, then flows north as the principal drainage to the south arm of San Francisco Bay. In recent geological times, Coyote Creek alternately flowed north to San Francisco Bay and south to join the Pajaro River flowing into Monterey Bay. The South Santa Clara Valley is drained by Llagas Creek and the Carnadero stream group which enter the valley from the Santa Cruz Mountains on the west and flow south to join the Pajaro River. The northwestern portion of the Pajaro River Sub-basin is formed by the Pacheco Creek drainage basin in the Diablo Range.

Most of the Pajaro River Sub-basin lies along the east side of the planning area, which receives relatively little precipitation. As can be expected, average stream flows per unit area, as shown in Table 11-13 are among the lowest in the planning area. Several reservoirs have been constructed in the Pajaro River Sub-basin primarily for the purpose of groundwater recharge. (See Table 13-1) Water is held in surface storage until conditions are favorable for streambed percolation to the groundwater basins.

Surface Water Hydrology

Streams within the Pajaro River Sub-basin often exhibit a flash runoff pattern. Discharge of San Benito River near Hollister has varied from a maximum of 11,600 cfs to a minimum of zero for some parts of each year. The Pajaro River at Chittenden has varied from a maximum discharge of 24,000 cfs (December 24, 1955) to zero flow at times in July and August 1948. Median monthly flows are shown in Table 11-13.

Groundwater Hydrology

Groundwater basins within the Pajaro River Sub-basin are complex, especially due to faulting in the area around Hollister. The area is primarily dependent on groundwater; approximately 90 percent of the water requirements of the sub-basin are met by groundwater pumping.

There are two major groundwater basins within the sub-basin. The Gilroy-Hollister Groundwater Basin upstream from Pajaro Gap and the Pajaro Valley Groundwater Basin downstream as shown in Figure 11-6.

Seven small valleys make up the Gilroy-Hollister Groundwater Basin. These include the South Santa Clara Valley, the Hollister Valley, the San Benito Valley, the Santa Ana Valley and three other small, contiguous valleys. The groundwater basin extends a distance of about 35 miles from the groundwater divide near Morgan Hill, southeasterly to Tres Pinos at the head of Hollister Valley. The width of the groundwater basin varies from three to sixteen miles and it has an area of approximately 250 square miles.

Beneath the flat floor of South Santa Clara Valley lie waterbearing alluvial sediments of Plio-Pleistocene and upper Quaternary ages. The Plio-Pleistocene sediments reach a maximum thickness of 4000 feet along the eastern edge. The upper Quaternary deposits are the principal source of groundwater in the South Santa Clara Valley. These deposits consist of interfingering and overlapping lenses and stringers of unconsolidated stream and lake deposits of gravel, sand, silt and clay ranging from a thin layer at the western edge of the valley to a maximum total thickness of perhaps 700 feet near the eastern edge.[16]

Throughout the South Santa Clara Valley, from Morgan Hill to the Pajaro River, movement of groundwater is generally to the south. Groundwater within the Coyote alluvial fan deposits is essentially unconfined. South of San Martin, groundwater conditions gradually change to confinement in a pressure area that extends south, in the central portion of the valley, to beyond the Pajaro River. South of Rucker there are three separate confined aquifers separated in the vertical direction by fine grained aquicludes.

The Hollister and San Benito groundwater basins which lie between the Gabilan and Diablo Ranges, are in hydraulic continuity with the South Santa Clara Valley groundwater basin. Water-bearing sediments in these basins include alluvium, terrace deposits and Dos Picachos gravels of Quaternary age, San Benito gravels of Plio—Pleistocene age and portions of the Purisima formation of Pliocene age. Both the Hayward Fault and the San Andreas Fault, major active faults, cross the basin. Structure of the area is complex, and the area is divided into several groundwater sub-basins due to faults which restrict lateral movement of groundwater. The area to the north of Hollister adjacent to the Pajaro River and in the San Juan Bautista area has a confining clay layer overlain by a shallow perched aquifer. In the Hollister area, groundwater moves toward a pumping depression, while movement in the San Juan Bautista area is generally northward toward the San Benito River.

The Pajaro Valley Groundwater Basin extends as far east as Pajaro Gap, as shown on Figure 11-6. In the valley floor, groundwater occurs in three distinct zones, the shallow, intermediate and deep zones, which merge into a forebay east and north of the City of Watsonville. This forebay area serves as the principal source of replenishment to the intermediate and deep zones.

The shallow zone varies in depth from 30 to 100 feet below the valley floor and is generally unconfined. There are numerous bodies of semi-perched water. The underlying intermediate zone generally extends to a depth of 200 to 300 feet. Groundwater is generally confined, but regions of semiconfinement exist and leakage from the shallow zone occurs. The deep zone is confined by an impermeable layer of blue clay and extends to a depth of about 800 feet.

In the upland area north and east of Watsonville, the San Andreas Fault zone forms a barrier to lateral movement of groundwater. Lateral movement does not appear to be limited elsewhere. Along Monterey Bay, the aquifers are open to the ocean; seasonal reversals of the normal seaward gradient have resulted from excessive summer pumping, and apparent sea-water intrusion has been noted since the early 1940's. Excessive chlorides extend about 1.5 miles inland from Monterey Bay in portions of the Pajaro Basin.

Salinas River Sub-Basin (05)

The Salinas River Sub-basin, with an area of about 4380 square miles, includes almost two-thirds of the Monterey Bay Regional Planning Area. The sub-basin includes the major portions of both Monterey and San Luis Obispo Counties and small portions of San Benito and Kern Counties. The sub-basin is bounded on the east by the Diablo and Gabilan Ranges and on the west by the Santa Lucia Range. The floor of the Salinas Valley is a highly developed agricultural area flanking the Salinas River and extending nearly 100 miles south from the mouth of the river at Monterey Bay.

Precipitation on the Salinas River Sub-basin varies between fairly wide limits from light to moderately heavy, and resultant runoff throughout the basin varies accordingly.

The most important tributaries of the Salinas River are the Nacimiento and San Antonio Rivers and the Arroyo Seco, all which drain portions of the Santa Lucia Range. Estrella and San Lorenzo Creeks, with headwaters in the Diablo Range, are the principal eastern tributaries; however, their runoff comprises only a small portion of the total basin runoff.

The valley floor area north of San Ardo has been heavily developed for agriculture since the turn of the century, based principally on groundwater development. There are large areas of irrigable land in the upper basin not as favorably situated with respect to groundwater supply that remain undeveloped or that are dry-farmed.

The Salinas River Sub-basin has generally been divided for the purpose of hydrologic analysis into an upper and lower basin, with the division at Wunpost. Groundwater basins in the Upper Basin include the Paso Robles and the Lockwood Valley Units, as shown in Figure 11-6. The groundwater basin in the Lower Basin is a single unit, in hydraulic continuity; however, it has been commonly divided into four or five units for the purpose of analysis. These units have been designated the "Pressure", "East Side", "Forebay", and "Upper Valley" Units. The Arroyo Seco Cone, within the Forebay Unit has sometimes been considered a separate area.

Surface Water Hydrology

Within the past 15 years, the hydrology of the Salinas River Sub-basin has been substantially changed by the construction of large reservoirs on Nacimiento and San Antonio Rivers, which store runoff for later release when conditions are favorable for groundwater recharge. The change in monthly stream flow patterns can be seen dramatically for the gage, Salinas River near Bradley, Table 11-14. Median monthly flow as a percent of annual flow is shown for two periods, 1948-57 and 1957-70. For the period 1948-57, median runoff for the four month period January through April is 82 percent of annual runoff. For the same four months for the period 1957-70, median runoff is only 26 percent of annual runoff. The dams have enabled much of the runoff to be released during the summer months.

The effectiveness of the summer release for groundwater storage can be seen by comparing median runoff for the Salinas River near Spreckels, Table 11-15, with median runoff for Salinas River near Bradley, Table 11-14. The gage near Spreckels is downstream from the Forebay unit where the summer releases have a chance to percolate. Median monthly flows at Spreckels are given for two periods, 1930-57 and 1957-70. The fact that the monthly patterns of median flow for the two periods are very similar shows that the summer reservoir releases are effectively percolating to groundwater storage.

Ground Water Hydrology

Water-bearing formations in the Salinas River Sub-Basin include sediments of the Paso Robles formation (Plio-Pleistocene), Aromas red sands and terrace deposits (Pleistocene), alluvium (Pleistocene Recent) and dune sands (Recent). The Paso Robles formation consists of up to 2000 feet of gravel, sand, silt and clay, in places partly consolidated, with some gypsum, fresh-water marl and limestone and at least one volcanic ash bed.[3] The largest area of Paso Robles sediments is in the Upper Basin, where it provides the principal source of water for both the Lockwood Valley Unit and the Paso Robles Unit. The Paso Robles formation flanks the floor of the Salinas Valley in the Lower Basin in places and probably underlies much or all of the valley below depths of 200 to 300 feet.[3] The permeability of the Paso Robles formation is variable, and quite high in some zones. The Aromas red sands at the nothernmost end of Salinas Valley and dune sands along the coast of Monterey Bay act as forebays for aquifers in the Pressure Unit in the Lower Basin. However, the principal source of recharge to the Pressure Unit is the Forebay Unit. The estimated groundwater safe yield in the Salinas Basin is 383,300 acre-ft/year. This includes 47,300 acre-ft in the Upper Basin and the remainder in the Lower Basin. Under present management practices, the yield in the Pressure area is estimated at 78,000 acre-ft/year, East Side 19,000 acre-ft/year, Forebay Unit 162,000 acre-ft/year and the Upper Valley 78,000 acre-ft/year.

Groundwater within the Upper Valley, Forebay and East Side Units is generally unconfined to partially confined. Within the Pressure Unit, aquifiers are overlain by nearly continuous marine deposits commonly referred to as "blue clay". Due to a lowering of the groundwater table in the East Side unit, poorer quality water from the Pressure Unit has been moving to the East Side Unit.

There are two principal pumping aquifers in the Pressure Unit which have been designated the 180-foot and 400-foot aquifers based on average depth below ground surface.

Carmel River Sub-Basin (06)

The Carmel River Sub-basin with a total area of about 254 square miles lies entirely within Monterey County and within the Santa Lucia Range. The sub-basin extends about 35 miles inland from Carmel Bay, with the major axis of the sub-basin lying in a northwest-southeast direction. Carmel Valley is the primary source of water supply to the Monterey Peninsula under present conditions. The present annual yield of the developed surface water supplies in the Carmel River is about 7,000 acre-ft. The present developed annual yield of the Carmel Valley groundwater basin is on the order of 6,000 acre-feet. Approximately 11,000 acre-feet of water from the Carmel Valley is exported to the Monterey Peninsula.

Monterey Coastal Sub-Basin (07)

It is anticipated that the Monterey Coastal Sub-basin will remain largely as an undeveloped area during the study period. This beautiful area extending along the coast from Carmel down to the Monterey-San Luis Obispo County line is

Table 11-14. Monthly Variation of Surface Runoff in Upper Salinas River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Dry (1960-61) in acre-feet	1,040	714	738	1,230	1,670	1,540	893	277	24,870	12,240	246	119	45,570
Wet (1968-69) in acre-feet	18,320	8,090	6,000	285,360	467,900	293,600	91,930	38,800	35,520	34,740	32,340	44,210	1,356,800
Median (1948-57)[b] in acre-feet	209	410	9,810	29,310	21,270	28,100	16,360	9,090	1,020	216	125	119	116,040[c]
As percent of annual runoff	0.2	0.4	8.4	25.3	18.3	24.2	14.1	7.8	0.9	0.2	0.1	0.1	100
Median (1957-70)[d] in acre-feet	17,030	8,090	3,920	12,480	13,690	15,060	16,660	23,920	24,810	30,990	32,590	25,880	225,120[c]
As percent of annual runoff	7.6	3.6	1.7	5.5	6.1	6.7	7.4	10.6	11.0	13.8	14.5	11.5	100

[a] Salinas River near Bradley. Drainage area - 2,535 square miles. Period of record - October, 1948 to present.

[b] Median discharge from 1948 to 1957 (9 years). Nacimiento Reservoir regulation began in November, 1956.

[c] Sum of monthly medians.

[d] Median discharge from 1957 to 1970 (13 years).

Table 11-15. Monthly Variation of Surface Runoff in Lower Salinas River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Dry (1960-61) in acre-feet	68	178	184	80	61	62	48	80	71	62	49	48	990
Wet (1940-41) in acre-feet	492	714	53,430	177,200	517,100	514,800	427,300	58,000	13,480	2,740	444	273	1,766,000
Median (1930-57)[b] in acre-feet	183	446	738	5,460	21,800	25,500	4,240	526	119	61	61	83	59,220[c]
As percent of annual runoff	0.3	0.8	1.2	9.2	36.8	43.1	7.2	0.9	0.2	0.1	0.1	0.1	100
Median (1957-70)[d] in acre-feet	275	282	1,080	6,330	20,020	17,770	756	689	234	95	96	178	47,800[c]
As percent of annual runoff	0.6	0.6	2.2	13.2	41.9	37.2	1.6	1.4	0.5	0.2	0.2	0.4	100

[a] Salinas River near Spreckels. Drainage area - 4,156 square miles. Period of record - October, 1929 to present.

[b] Median discharge from 1930 to 1957 (27 years). Nacimiento Reservoir regulation began in November, 1956.

[c] Sum of monthly medians.

[d] Median discharge from 1957 to 1970 (13 years).

traversed by Highway 1. There are numerous small watersheds draining the coastal slope of the Santa Lucia Range. The largest watershed is that of the Big Sur River. Groundwater in most of the sub-basin is very limited and no significant development is expected during the study period.

San Luis Obispo Coastal Sub-Basin (08)

The San Luis Obispo Coastal Sub-basin encompasses the coastal region of San Luis Obispo County southwest of the Santa Lucia Mountains as far south as the watershed divide with the Santa Maria River. Within the sub-basin are three distinct hydrologic sub-units. These are the Cambria, San Luis Obispo and Arroyo Grande sub-units. This sub-basin is characterized by mountainous and hilly terrain with numerous small stream valleys and the more expansive Arroyo Grande coastal plain.

Surface Water Hydrology

Several minor streams drain the western slopes of the Santa Lucia Range; however, most runoff escapes to the ocean. All water courses flow during the winter months while some are completely dry during the summer. Seasonal and monthly runoff varies with the precipitation that occurs on the tributary watershed areas. About ninety percent of the north coastal streamflow occurs during the seven-month period November through May. Records for the gaging station on Arroyo Grande Creek at Arroyo Grande indicate flow throughout the entire year.[17] However, the records of a gaging station further upstream reveal only seasonal flow, indicating that the downstream flow arises from discharges from the groundwater basin or irrigation return waters.

Runoff per square mile of drainage area in the extreme north end of the sub-basin is relatively high owing to the occurrence of heavy precipitation. Arroyo de la Cruz Creek is one of the most productive streams in all San Luis Obispo County. At the station near San Simeon, annual runoff averaged about 37,430 acre ft from 1950 to 1968, amounting to over 900 acre ft per square mile. The monthly variation of surface runoff in Arroyo de la Cruz and Santa Rosa Creek near Cambria during a wet, a dry, and a median year of record are shown in Tables 11-16 and 11-17, respectively.

Three storage reservoirs totaling 92,000 acre ft of storage capacity are located within the San Luis Obispo Coastal Sub-basin. The respective safe yields for Whale Rock, Chorro and Lopez reservoirs are 4,000, 150 and 6,230 acre ft/year.[17] Although several small lakes exist through the Arroyo Grande hydrologic sub-unit, they are viewed only as a minor contribution to surface water supply. These lakes fluctuate in surface areas seasonally, reaching a maximum of about forty acres.

Groundwater Hydrology

Fifteen individual groundwater basins are located throughout the San Luis Obispo Coastal Sub-basin with estimated safe annual yields ranging from zero to 6,500 acre feet per year, with the Arroyo Grande groundwater basin as the largest.[17] Groundwater occurs in the alluvium, older sand dunes, Paso Robles Formation and to a minor extent in fractures and slightly permeable zones in older nonwater-bearing rocks. In the alluvium it is generally unconfined, although small clay layers may cap the surface near the mouths of some groundwater basins.

Water levels rise for a portion of the year and in several locations the groundwater table is very near the ground surface. Groundwater moves in the direction of the surface slope except in the Los Osos Basin, where it moves in a northerly direction in the older sand dunes. Pumpage of groundwater is the only other impairment to a seaward movement.

The principal producing aquifer appears to occur within the alluvial deposits in each of the individual groundwater basins. The specific capacity of wells currently in operation is on the order of fifteen gallons per minute per foot of drawdown but may reach as high as forty for some wells in the Arroyo Grande groundwater basin. Table 11-18 gives the perennial safe yield of the groundwater supplies within the San Luis Obispo Coastal Sub-basin.

Soda Lake Sub-Basin (09)

The Soda Lake Sub-basin is a large enclosed basin located in the southeasterly portion of San Luis Obispo County. The watershed area of the sub-basin covers about 447 square miles, ninety-five percent of which is contained within San Luis Obispo County. Small portions of the drainage area tributary to this basin extend into Kern County. It is separated topographically from the Salinas River Sub-basin by a low drainage divide between the Temblor and La Panza Mountain Ranges. The Caliente Range forms the drainage

Table

Table 11-16. Monthly Variation of Surface Runoff in Arroyo de la Cruz[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1960-61) in acre-feet	0	0	0	2,690	987	608	94	3.4	0	0	0	0	4,382
As a percent of annual runoff	-	-	-	61.5	22.6	13.8	2.1	-	-	-	-	-	100
Wet (1968-69) in acre-feet	0	0	2,110	70,700	31,570	6,000	2,950	634	260	22	0	0	114,246
As a percent of annual runoff	-	-	1.8	61.9	27.7	5.2	2.5	0.7	0.2	-	-	-	100
Median in acre-feet[b]	0	0	3,310	5,560	4,097	2,580	1,590	639	187	12	0	0	17,975[c]
As a percent of annual runoff	-	-	18.4	30.9	22.8	14.4	8.8	3.6	1.0	0.1	-	-	100

[a] Arroyo de la Cruz near San Simeon, 1.7 miles upstream from mouth. Drainage area - 41.2 square miles. Period of record - October 1950 to present
[b] Median discharge from 1952 to 1970 (19 years)
[c] Sum of monthly medians

Table 11-17. Monthly Variation of Surface Runoff in Santa Rosa Creek[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1960-61) in acre-feet	6.9	0	0	250	145	110	49	24	6.2	0	0	0	591
As a percent of annual runoff	1.2	-	-	42.4	24.6	18.6	8.2	4	1	-	-	-	100
Wet (1968-69) in acre-feet	0	6.6	290	11,290	6,220	1,760	1,390	467	270	119	48	33	21,893
As a percent of annual runoff	-	-	1.3	51.8	28.5	8	6.3	2.1	1.2	0.5	0.2	0.1	100
Median in acre-feet[b]	5.6	31	290	929	1,050	564	276	138	70	18	3.2	0	3,374[c]
As a percent of annual runoff	0.2	0.9	8.6	27.5	31.1	16.7	8.2	4.1	2.1	0.6	0	0	100

[a] Santa Rosa Creek near Cambria. Drainage area - 12.5 square miles. Period of record - August 1957 to present
[b] Median discharge from 1958 to 1970 (13 years)
[c] Sum of monthly medians

Table 11-18. **Perennial Safe Yield of Groundwater Basins in the San Luis Obispo Coastal Sub-basin**

Groundwater basin	Estimated perennial safe yield, acre-feet year[a]
San Carpoforo Creek	0
Arroyo de la Cruz	430
San Simeon Creek	320
Santa Rosa Creek	630
Villa	1,030
Cayucos	630
Old	330
Toro	530
Morro	1,700
Chorro	1,700
Los Osos	1,000
San Luis Obispo	2,250
Pismo	2,000
Arroyo Grande	6,500
Total	19,050

[a]Report on Master Water and Sewerage Plan, County of San Luis Obispo California, May 1972.

Table 11-24. **Perennial Safe Yield of Groundwater Basins in the Santa Barbara Coastal Sub-basin**

Groundwater basin	Estimated perennial safe yield, acre-feet year
Ellwood Gaviota[a]	6,000
Goleta[b]	5,800
Santa Barbara[c]	1,700-2,000
Montecito[c]	2,500
Carpinteria[b]	1,700
Total	17,700-18,000

[a]Ground-Water Resources, Ellwood-Gaviota Area, Calif. U.S. Department of Interior, Geological Survey, 1968

[b]Yield of the Carpinteria and Goleta Ground-Water Basins, U.S. Department of Interior, Geological Survey, 1962

[c]Ground Water Reconnaissance of the Santa Barbara Montecito Area, U.S. Department of Interior, Geological Survey, 1968.

divide between the southerly portion of the Carrizo Plain and the Cuyama Valley. To the east, the Temblor Mountain Range separates the sub-basin from the Tulare Lake Basin. Elevations vary from 1,900 feet above sea level at Soda Lake near the center of the sub-basin to 5,095 feet at Caliente Mountain. The average elevation of the valley floor is about 2,000 feet above sea level.

Surface Water Hydrology

Precipitation in the Soda Lake Sub-basin is moderate when compared to the remainder of the Central Coastal Basin. Mean seasonal precipitations for Soda Lake and Carrizo Plain stations are 8.7 and 8.9 inches respectively. Several small creeks drain the steep slopes of the Caliente and Temblor Mountain Ranges in the southern portion of the sub-basin. However, flow diminishes once the creekbed enters the valley floor. Consequently, groundwaters of the Soda Lake Sub-basin constitute the only local supply of water to the overlying lands at the present time. Very little information is available concerning the sub-basin's runoff characteristics.

Groundwater Hydrology

The groundwater basin underlying the Carrizo Plain is the second largest in the Central Coastal Basin. It contains 172,000 surface acres and abuts the foothills of the Caliente and Temblor Mountain Ranges, extending the entire length of the plain. Soda Lake is situated at its approximate center.

For the most part groundwaters within the Soda Lake Sub-basin are replenished around the edges of the valley by infiltration of precipitation and stream flow resulting from infrequent storms. The quantity of groundwater in storage is depleted by evapo-transpiration and pumped withdrawals. Small springs in the creeks draining into San Juan Creek on the northwest side of the Carrizo Plain suggest that a small amount of leakage occurs from the Soda Lake Sub-basin into the Salinas Sub-basin.

The quality of water in the alluvium is inferior to the water in the Paso Robles Formation, suggesting that deeper, fresher water is not replenished through vertical percolation within the area of use. Thus groundwater of good quality in the Soda Lake Sub-basin appears to be covered by a relatively impervious layer except at its edges.

The majority of the wells in the sub-basin are located in the northern portion of the sub-basin near Simmler. There water is extracted from the alluvium of Recent and Upper-Pleistocene ages and the Paso Robles Formation of Plio-Pleistocene age consisting of nonmarine sand, gravel and clays up to 1,000 feet in thickness. Flow of the groundwaters in the sub-basin is generally toward the vicinity of drawdown cones of wells.

Because of limited recharge, the safe seasonal yield of the Soda Lake groundwater basin is believed to be quite small. Sufficient hydrologic and geologic data are not currently available on which to base an accurate estimate of the maximum potential safe yield of the groundwater basin. Geologic evidence indicates that the total storage capacity of the groundwater basin beneath the Carrizo Plain is on the order of several tens of thousands of acre feet. Presently, however, the safe yield of the developed groundwater supplies is about 1,600 acre feet annually, approximately the current consumptive use. Groundwater levels have remained constant with a moderate increase in rate of water withdrawal.

The practicability of the basin's full utilization remains questionable. Further use of groundwaters in the Soda Lake Sub-basin could result in a lowering of the groundwater level and possible degradation of the better quality waters. Also there is a potential threat of an unfavorable salt balance which is likely to increase through constant reuse of irrigation return flows, should overlying agricultural lands be extensively irrigated.

Because of geologic considerations, at this time, it is assumed that the importation of water and extensive irrigation of land in the Carrizo Plain would cause the formation of a permanent body of water at Soda Lake, replenished principally from return irrigation waters. If such a full development were to occur, the lake would increase in size to an estimated 7,800 acres.[19] This stabilized condition would prevail when the net evaporation from the lake surface would just equal the total return flow from applied irrigation waters.

Santa Maria River Sub-Basin (10)

The Santa Maria River Sub-basin comprises approximately 1,850 square miles and is drained by the Santa Maria River with its two principal tributaries, the Cuyama and Sisquoc Rivers. Hydrologically, the sub-basin is separated from neighboring sub-basins by the La Panza, Caliente, and San Rafael Mountains in the eastern portion of the valley and several low lying hills along the Pacific Coast. Major features include the Santa Maria, Sisquoc, and Cuyama Valleys and the Twitchell Reservoir. The Santa Maria Valley floor varies in elevation from sea level to about 300 feet while both Cuyama and Sisquoc Valleys average about 2,300 feet above sea level. Near the headwaters of the Sisquoc River is Big Pine Mountain, elevation 6,538, the highest elevation in Santa Barbara County.

Surface Water Hydrology

The most significant demand for water within the sub-basin is that of irrigation for numerous agricultural operations. Water for this purpose is provided almost solely by groundwater supplies. As such, an understanding of surface water hydrology is important in evaluating groundwater recharge capability and possible degradation by surface waters low in quality which percolate into groundwater aquifers.

The principal means of groundwater recharge is through precipitation, surface flow from upstream areas and infiltration of irrigation return water. Stream flow records in the Santa Maria River Valley area have been maintained since 1929. Three gaging stations of importance are those stations on Cuyama and Sisquoc Rivers and the station on the Santa Maria River at Guadalupe. The two located on the Cuyama and Sisquoc Rivers measure the main surface inflow to the Santa Maria Valley. These streams have demonstrated an average annual flow of 44,000 and 21,000 acre ft, respectively since records were initiated in 1941 for Sisquoc and 1959 for Cuyama.[18] The monthly variation of surface runoff in Sisquoc River near Sisquoc during a wet, a dry, and a median year of record is shown in Table 11-9. The station on the Santa Maria River at Guadalupe measures flow beyond the recharge area to the main groundwater basin in the Santa Maria Valley. Average annual flow there has been 15,000 acre feet since 1941.[19] In February 1959, Twitchell Reservoir, capacity 239,000 acre feet, spilled for the first time. The impounded water was released throughout the year to recharge the groundwater basin in the Santa Maria Valley, thus producing the longest sustained flow downstream on record in the Cuyama and Santa Maria Rivers.

Groundwater Hydrology

Within the Santa Maria River Sub-basin there are four major and four minor groundwater storage units with a surface area of 107,000 acre-feet. Total storage capacity for all groundwater reservoirs within the sub-basin is around 2 million acre-feet.[20] These figures do not include groundwater storage capacity in the Cuyama Valley.

It is estimated that most of the groundwater is currently extracted from the lower portion of Recent alluvium. Only a few wells obtain water from the deeper aquifers within the basin. Water levels have fluctuated seasonally as well as over long periods. The trend is generally for the groundwater basin to be recharged during winter and spring seasons while drawdown occurs largely during late summer and fall as a result of pumpage. Additionally, similar water level fluctuations are observed at different locations within the same time frame indicating both relatively high permeability and continuity among aquifers. The most significant changes are due to the construction of Twitchell Dam which causes water levels to rise as water is released to recharge acquifers. For the period spring 1968 - spring 1969 water levels averaged .5 foot higher near Guadalupe, 8 feet lower near the confluence of Cuyama and Sisquoc Rivers, 4 feet higher at Terrace south of the Santa Maria River, 3 feet higher north of the Santa Maria River; and 14 feet higher in the Cuyama, Santa Maria and Sisquoc groundwater basins.[21]

Water generally moves westward and away from the Sisquoc and Santa Maria Rivers. The gradient is northward from the Casmalia and Salmon Hills and southward from the western part of Nipomo upland area. In the Cuyama Valley the groundwater follows the course of the river. It has been estimated by the U.S. Geologic Survey (U.S.G.S.) that the cumulative perennial safe yield of groundwater basins in the Santa Maria Valley is between 56,100 and 58,000 acre feet. The corresponding safe yield for Cuyama Valley is approximately 9,000 - 13,000 acre feet per year.[22]

San Antonio Creek Sub-Basin (11)

The San Antonio Creek Sub-basin covers an area of 211 square miles and lies in the west -central part of Santa Barbara County, about 55 miles northwest of Santa Barbara and 15 miles south of Santa Maria. It is situated between the Santa Maria River and Santa Ynez River Sub-basins and is bounded on the north by the Solomon and Casmalia Hills, and on the south by the Purisima Hills. The area, which coincides with the drainage basin of San Antonio Creek, includes the Los

Table 11-19. Monthly Variation of Surface Runoff in Sisquoc River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1960-61) in acre-feet	54	50	60	87	95	102	88	75	49	31	30	35	756
As a percent of annual runoff	7.1	6.6	7.9	11.5	12.6	13.6	11.6	9.9	6.5	4.1	4	4.6	100
Wet (1968-69) in acre-feet	47	45	454	89,610	96,160	44,700	17,420	6,840	3,230	1,610	830	421	261,367
As a percent of annual runoff	-	-	.1	34.3	36.9	17.3	6.6	2.6	1.2	0.6	0.3	0.1	100
Median in acre-feet[b]	67	71	343	615	1,960	1,580	1,250	821	202	119	77	76	7,181[c]
As percent of annual runoff	0.9	1.0	4.8	8.6	27.3	22.0	17.4	11.4	2.8	1.7	1.1	1.0	100

[a] Sisquoc River near Sisquoc. Drainage area - 281 square miles. Period of record - October 1943 to present
[b] Median discharge from 1944 to 1970 (27 years)
[c] Sum of monthly medians

Table 11-20. Monthly Variation of Surface Runoff in San Antonio Creek[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1967-68) in acre-feet	46	49	88	115	153	207	104	55	38	32	25	22	934
As a percent of annual runoff	4.9	5.2	9.4	12.3	16.3	22.1	11.1	5.8	4	3.4	2.7	2.4	100
Wet (1968-69) in acre-feet	30	47	89	3,580	8,350	1,480	364	126	69	62	52	53	14,302
As a percent of annual runoff	0.2	0.3	0.6	25	58.6	10.4	2.6	0.8	0.5	0.4	0.3	0.3	100
Median in acre-feet[b]	80	168	223	354	320	244	251	105	69	49	46	50	1,959[c]
As a percent of annual runoff	4.1	8.6	11.4	18.1	16.3	12.5	12.8	5.4	3.5	2.5	2.3	2.5	100

[a] San Antonio Creek near Casmalia. Drainage area - 135 square miles. Period of record - October 1955 to present
[b] Median discharge from 1956 to 1970 (15 years)
[c] Sum of monthly medians

Alamos Valley in the upstream portion of the drainage basin and the San Antonio Valley in the downstream portion.

Surface Water Hydrology

The amount of precipitation that becomes runoff is dependent on many factors, the most important of which are the density and type of vegetation, the soil permeability, evaporation rates and seasonal distribution, geologic and topographic environments, the intensity and time of distribution of rainfall, and the moisture content of the soil prior to rainfall. Time distribution and intensity of rainfall are the two principal factors that influence runoff in the San Antonio Creek Sub-basin. Eighty percent of the rainfall occurs in the four month period from December through March. The number of storms are few, however, their intensity is usually great. Thus, the bulk of the runoff is concentrated in a few short periods each winter.

Measurements at two gaging stations have been maintained in the sub-basin. A station at Harris was in use from January 1940 through September 1955. The magnitude of runoff ranges from zero in 1948 to 20,650 acre feet in 1941 while the average annual runoff for the period 1952-55 was 800 acre feet.[23]

Subsequent to September 1955, a new station was placed in operation at Casmalia, identified as the San Antonio Creek Station. This station records the runoff from a drainage area of 137 square miles and provides a record of surface and groundwater outflow from the valley.

The flow of San Antonio Creek is continuous at the new station because of a barrier of consolidated rocks that cuts across and underlies the valley at shallow depth. During fifteen years of record, base flow of the creek below the barrier has ranged from 40 acre-feet per month during the summer to 200 acre-feet per month in the winter. The monthly variation of surface runoff in San Antonio Creek near Casmalia during a wet, a dry, and a median year of record is shown in Table 11-20. As of 1955-70, the groundwater outflow from the basin was about 1,500 acre ft/year; the total average discharge was 4,300 acre ft/year.[24]

Groundwater Hydrology

Groundwater in the San Antonio Creek Sub-basin occurs in most of the unconsolidated deposits that have filled the San Antonio trough. The water bearing deposits include alluvium, Orcutt sand, Paso Robles Formation and Careaga sand. The groundwater body extends westward from the Zaca-Foxen Canyon area to the ocean.

Movement of the groundwater beneath the valley is controlled by geologic structure and lithologic changes within aquifers. Groundwater in the upper and central parts of the valley has a westward hydraulic gradient averaging 30 feet per mile. As the groundwater approaches Harris, its movement is restricted to a thin narrow strip of alluvium which has filled the trough cut through consolidated tertiary rocks. Therefore, virtually all groundwater comes to the surface at this point and is subsequently wasted to the ocean.

The groundwater basin is recharged principally by infiltration of rain and seepage from streambeds. All recharge is local, that is it occurs within the drainage area. Long term average recharge by infiltration of precipitation in the San Antonio Creek Sub-basin, based on 49 years of precipitation records at Los Alamos, has been estimated by U.S.G.S. at approximately 4,500 acre ft/year.[24] Groundwater is withdrawn from the aquifer by evapotranspiration, springs, subsurface outflow, and net pumped withdrawals. The total withdrawal for the period 1943 through 1958 is on the order of 7,600 acre feet annually. In 1963 Vandenberg Air Force Base began to pump groundwater from a supply well near the Barka Slough. During November 1968 through November 1969, the water levels in their wells rose an average of eighteen feet, indicating that the pumping that year had not lowered the water table nor decreased groundwater in storage near the Barka Slough.[24] The integrated surface and groundwater safe yield for San Antonio Creek Sub-basin is estimated by the U.S.G.S. at about 7,000 acre feet annually.

Santa Ynez River Sub-Basin (12)

The Santa Ynez River Sub-basin encompasses about 900 square miles in Santa Barbara County. The Santa Ynez River parallels the westward-trending reach of the coast from which it is separated by the narrow Santa Ynez Mountains. On the north the sub-basin is bounded by the Purisima Hills and the San Rafael Mountains. Elevations in the sub-basin range from sea level at the mouth of the Santa Ynez River to 300 feet through the central valley of the basin to well over 4,000 feet above sea level near the eastern boundary of Santa Barbara County. The Santa

Table 11-21. Monthly Variation of Surface Runoff in Santa Ynez River[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1954-55) in acre-feet	0	25	.8	451	271	588	116	223	.2	0	0	0	1,675
acre-feet	0	25	.8	451	271	588	116	223	.2	0	0	0	1,675
As a percent of annual runoff		1.4	-	26.9	16.2	35.2	6.9	13.4	-	-	-	-	100
Wet (1968-69) in acre-feet	0	0	0	203,100	276,000	107,900	19,380	8,060	2,010	1,140	115	94	617,799
As a percent of annual runoff	-	-	-	32.4	44.8	17.6	3.3	1.4	0.3	0.1	-	-	100
Median in acre-feet[b]	0	0	46	737	3,450	2,730	1,200	513	53	15	0.8	0	8,744[c]
As a percent of annual runoff	-	-	.53	8.43	39.45	31.22	13.72	5.87	.61	.17	.01	0	100

[a] Santa Ynez River near Lompoc. Drainage area - 789 square miles. Period of record - January 1940 to present
[b] Median discharge from 1954 to 1970 (15 years) since the construction of Cachuma Reservoir. No data for 1961 and 1964
[c] Sum of monthly medians

Table 11-22. Safe Perennial Yield of Groundwater Basins in Santa Ynez River Sub-Basin

Groundwater Basin	Yield, acre feet
Santa Ynez Upland[a]	700 - 7,500
Buellton[b]	2,400 - 7,600
Santa Rita[b]	1,400 - 7,500
Lompoc[b]	20,000
Total	24,500 - 42,600

[a] Groundwater Resources of The Santa Ynez Upland Groundwater Basin Santa Barbara County Ca., United States Department of the Interior, Geological Survey, April, 1968.
[b] Geology and Water Resources of the Santa Ynez River Basin, Santa Barbara County, California, United States Department of the Interior, Geological Survey Water Supply Paper 1107, 1951.

Ynez River Sub-basin is made up of five hydrologically distinct sub-units. These sub-units are designated Headwater, Santa Ynez, Buellton, Santa Rita and Lompoc sub-units.

Surface Water Hydrology

Runoff from the Santa Ynez River Sub-basin is a complex and varying function of precipitation. Flow in the Santa Ynez River is seasonal with no flows occurring during the summer months. Nearly seventy-five percent of the annual flow is concentrated during the three- month period of February, March and April. The average annual discharge of the Santa Ynez River to the Pacific Ocean, recorded at Surf, California, is approximately 60,000 acre feet and has varied from a maximum of 172,000 acre feet to a minimum of 19 acre feet over a twenty- seven year period 1925 through 1952.[25] The monthly variation of surface runoff in the Santa Ynez River near Lompoc during a wet, a dry, and a median year of record since the construction of the Cachuma dam is shown in Table 11-21.

Three significant surface water developments in the Santa Ynez River Sub-basin are the Jameson, Gibraltar and Cachuma reservoirs. Together these facilities represent 225,000 acre feet of storage capacity providing a cumulative safe annual yield of 33,000 acre feet.[25] The bulk of this water, however, is not used within the Santa Ynez River Sub-basin but is delivered through tunnels to neighboring Santa Barbara County coastal plain communities, such as Santa Barbara, Montecito, Summerland and Carpinteria.

Groundwater Hydrology

The main bodies of unconsolidated water-bearing deposits in the Santa Ynez River Sub-basin occur in the Santa Rita and Los Alamos-Tequepis synclines. The Santa Rita syncline lies immediately north of the Santa Rita Hills and begins west of Buellton. The Santa Ynez River does not occupy either of these main synclines. In the Headwater and Santa Ynez sub-unit, the river is south of the Tequepis syncline. In the Buellton sub-unit it crosses the east end of the Santa Rita syncline, then enters its broad valley across the unfolded consolidated rocks of the Santa Rita sub-unit. Below the narrows, the river leaves the unfolded area and in the Lompoc sub-unit it swings west. Therefore, only near Buellton and in the Lompoc sub-unit for about eighteen miles of its course is the Santa Ynez River in direct contact with major bodies of water bearing sediments.

Water supply and development for local use within the Santa Ynez River Sub-basin has been almost solely from groundwater resources. Groundwater basins along the tributaries of the Santa Ynez River are located in older alluvium while the main stem of the Santa Ynez River has several basins of Recent alluvium.

Each of the basins in which groundwater has been developed is relatively independent of others and infiltration rates vary widely. Water is confined in individual groundwater basins except in the alluvial deposits adjacent to the Santa Ynez River where it flows in accordance with the land gradient. Artesian conditions have been known to exist within the Paso Robles Formation where steeply dipping strata of gravel and sand crop out in high catchment areas and are confined or partially confined by less permeable beds of clay and silt. Where valleys are narrow and the cross-sectional area of alluvial fill is decreased, water may be forced to the surface to move as intermittent or perennial flow in stream channels.

Estimated safe annual yields for groundwater basins within the various sub-units are tabulated in Table 11-22. An aggregate total of 42,600 acre feet has been estimated as the total annual safe yield of the groundwater basins in the Santa Ynez River Sub-basin.

Santa Barbara Coastal Sub-Basin (13)

The Santa Barbara Coastal Sub-basin is the narrow coastal strip south of the Santa Ynez Mountains, extending eastward from Point Arguello to the Ventura County line. The Santa Ynez Mountains are a linear, rugged transverse range rising steeply from Point Arguello on the western coast to elevations of 2,000 to over 4,000 feet. The portions of the coastal strip, normally less than one mile wide west of Goleta, consist mostly of elevated alluvial terraces. These terraces slope toward the ocean and terminate at the coast line in steep cliffs 50 to 150 feet high. From Goleta to Carpinteria the coastal terrace widens to about 3 miles. Due to its history and scenic beauty, this area is the most populated area in the southern Central Coastal Basin.

Surface Water Hydrology

Many southward-flowing streams drain the southern slope of the Santa Ynez mountains. During a major portion of the year, flow in the streams is relatively low, but during and shortly

Table 11-23. Monthly Variation of Surface Runoff in Atascadero Creek[a]

Type of year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Annual
Dry (1950-51) in acre-feet	.6	0	22	0	0	3.8	2.4	0.4	0.4	0.8	5.4	0.2	36.0
As a percent of annual runoff	1.6	-	61.2	-	-	10.6	6.7	1.1	1.1	2.2	15	0.5	100
Wet (1968-69) in acre-feet	29	11	42	14,120	5,340	814	614	41	2.9	1.9	0.7	1.2	21,017
As a percent of annual runoff	0.6	-	0.2	67.2	25.3	3.7	2.8	.2	-	-	-	-	100
Median in acre-feet[b]	0	1.8	42	63	92	111	17	4.9	1.4	0.6	0.2	0.4	334[c]
As a percent of annual runoff	-	.54	12.56	18.85	27.52	33.20	5.09	1.47	.42	.18	.06	.12	100

[a] Atascadero Creek near Goleta, 1.3 miles upstream from mouth. Drainage area - 18.8 square miles. Period of record - January 1942 to present
[b] Median discharge from 1942 to 1970 (29 years)
[c] Sum of monthly medians

after periods of heavy precipitation, from December through April, they may be swollen with runoff. The total runoff of streams entering the Carpinteria basin from 1941 to 1945 is estimated on the basis of acre-feet/year and averages about 10,000 acre feet per year.[26] Nearly all of this runoff passes the recharge area and discharges to the ocean. Runoff for the Ellwood-Gaviota area has been estimated by the U.S.G.S. to be 230 acre ft/year/square mile for similar streams in the Santa Barbara area, thus the total flow of streams in the Ellwood-Gaviota area would be about 24,000 acre ft/year.[27] The monthly variation of surface runoff in Atascadero Creek near Goleta during a wet, a dry, and a median year of record is shown in Table 11-23.

Groundwater Hydrology

Groundwater basins are contained in central alluvial plains bordered by foothills and terrace remnants underlain to a depth of several thousand feet by unconsolidated water bearing deposits. Groundwater is pumped from the deep groundwater bodies consisting of older alluvium contained in both Casitas and Santa Barbara formations. In the Ellwood-Gaviota area most of the groundwater occurs in the consolidated rocks. Here the water is in fractures and intergranular spaces in partly cemented sandstone.

Generally, groundwater moves in a southwesterly direction, coincident with surface contours. In the Carpinteria deep water basin, water moves southward and southwestward mainly from the foothill area in the eastern and northeastern parts of the basin. Groundwater in the Goleta basin flows southwestward from its main recharge area adjacent to the foothills. Movement is greatly restricted by impermeable zones along faults so that water levels along some of them are locally as much as 100 feet higher on the up gradient side than on the down gradient side. In the Ellwood-Gaviota area groundwater movement follows the land contours generally southward toward the ocean. The gradient is very steep in the mountainous and hilly locations but decreases to 80 feet per mile on the coastal plain.[27] The sharp change is a result of a break in the slope of the valley near the contact between the shale units and sandstone units.

Recharge results principally from infiltration of rain, seepage losses from streams, and irrigational return flows. Groundwater yields have been studied by various investigators employing differing techniques. The U.S.G.S. estimates data precludes more than preliminary estimates of perennial yields. For various sub-units located in the Santa Barbara Coastal Sub-basin, the estimated safe perennial yield is summarized in Table 11-24.

CHANNEL ISLANDS

Offshore, the Channel Islands of Southern California are divided into two groups, the Santa Barbara and Catalina. The Santa Barbara group, to the north, consisting of the Anacapas, Santa Cruz, Santa Rosa and San Miguel, forms a string of islands separated from the mainland by the Santa Barbara Channel. Three of the islands are included in the south Central Coastal Basin study group but the Anacapa Islands in Ventura County are included in the Los Angeles Basin.

The Santa Barbara group is a continuation of the Santa Monica Mountains; a granite ridge capped by complex anticlinal structures. Rough terrain dominates the landscape and its narrow stream-dissected valleys have steep gradients. Lower portions of some valleys are submerged. Wave-cut terraces are found as high as 1,500 feet above sea level. Some islands have surprisingly level summit uplands.

The climate of the channel islands reflects the maritime influence and the absence of mountain range influence. Summers are cooler due to the surrounding cool water temperatures. Elevations are insufficient to produce much orographic effect during winter cyclonic storms.

Due to their isolation from the mainland (20-70 miles), inaccessibility and historic land use patterns, little water quality or quantity data exist. The land use and occupancy patterns reflect a potential limited supply of water.

San Miguel is the most westerly of the east-west oriented islands. Barren and windswept, the island has been used as a sheep ranch but it has been unoccupied since 1942. Littoral waters and the rocky shores provide a habitat for the once almost extinct sea elephant.

Santa Rosa was the only land grant island during the Mexican period. It continues to serve as a cattle ranch owned by a Santa Barbara concern. Cattle are shipped to the mainland on barges and public access is restricted. The U.S. Air Force also maintains a small aerial defense base.

Santa Cruz, the largest of the Santa Barbara group displays a more diverse pattern. Stands of pines, manzanita and eucalyptus indicate more available moisture. Like Santa Rosa, cattle ranching is the dominate land use pattern; hay cultivation supplements native pastures.

One of the two land owners on the island has proposed a recreation, residential development. The developer indicated a sufficient water supply is available but supporting data does not exist. The entire area is virtually devoid of water investigation data.

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Chapter 12 Population, Land Use and Economy

Estimates of future waste flows and loads are required for developing a comprehensive water quality management plan. These estimates are based, in large part, on anticipated future population and development during the planning period (present to 2000). Underlying these projections is an evaluation of social changes which have occurred in California and nation-wide during the past decade which influence the rate and distribution of population growth and economic development in the basin. The direction of future land use planning both statewide and locally also affects population projections through controlled development densities and by bringing pressure for retention of more open and recreational space in urban areas. A land use analysis will also indicate the type of land use activity that may be expected in the basin. This analysis is taken into consideration in formulating economic and population projections.

POPULATION

Two sources of population projections were used; the State Department of Finance (DOF) and the County planning departments within the Central Coastal Basin.

Three population forecasts provided by the State Department of Finance for each of the counties within the basin were allocated to the sub-basins. In essence the forecasts cover the range of expected population growth. On the low side the ALTERNATIVE E-ZERO forecast assumes a fertility rate of 2.11 and a net immigration of zero for each year from 1970 through 2000. In the middle, the BASE PLAN (D-150) forecast assumes a fertility rate of 2.45 with net immigration assumed to stabilize at 150,000 for the years 1980 to 2000. Immigration for individual years during the seventies increases from a low of 29,000 during 1969-70 to the stabilized rate of 150,000 per year in 1980. On the high side, the ALTERNATIVE C-300 forecast assumes a fertility rate of 2.78 and a net immigration of 300,000 for the years 1980 to 2000. During the seventies immigration is expected to increase from 29,000 in 1969-70 to the stable rate of 300,000 in 1980. This information is presented in Table 12-2.

The Department of Finance's Base projections, with a fertility rate of 2,450 births per thousand women and a state net annual in-migration of 150,000 persons, is considered the most probable growth alternative for the Central Coastal Basin and is used in the development of alternative water quality control plans.

A request was made of each county agency to provide forecasts of population for the planning period. Table 12-3 compares the three Department of Finance population forecasts by county or portions of counties in the Central Coastal Basin with those provided by the county agencies.

The major differences between the Department of Finance and County projections in the AMBAG area occur in Santa Clara and Santa Cruz Counties. Santa Clara County forecasts growth in the Morgan Hill to Gilroy corridor to occur at a much slower rate than that foreseen by the DOF, while the reverse is true in Santa Cruz County. A significant difference occurs in Santa Barbara County. The two projections are close through the year 1980, after which there is a substantial divergence; the Department of Finance projects 568,000 persons by the year 2000, while the County Planning Department projects 449,000 persons for the same period.

Since population and certain land use categories were needed on a detailed basis in order to determine the quantity and quality of water required for municipal, industrial and agricultural purposes and to estimate wastewater loads, it was necessary to delineate planning units within the counties. The planning areas for the AMBAG area are shown in Figures 12-1A, 1B, 1C. Table 12-4 lists the AMBAG population by planning areas for the period 1970 to 2000 based on the Department of Finance Base Plan forecast. Planning subareas for the southern portion of the Central Coastal Basin are illustrated in Fig. 12-2. Present and future populations for the southern areas are tabulated in Table 12-5.

TECHNICAL NOTE

The Department of Finance (DOF) continuously updates the statewide population projections at intervals of from two-to-three years or when special conditions dictate on the basis of the most current demographic and migration criteria. This has been DOF's policy in the past and is expected to continue in the future. The water quality control plans are based on the DOF population projections developed in 1971. However, it should be noted that utilization of DOF's demographic data does not constitute an endorsement by the State Board of such projections, but is a

Table 12-1. Comparison of Statewide Population Projections for Year 2000 (in Thousands)

Series	1971 Projections	1974[a] Projections	1971 Less 1974	Percent Reduction
E-O[b]	26,499.9	24,746.0	1,753.9	6.6
D-150[c]	32,567.0	30,489.0	2,078.0	6.4
D-100[d]	-	29,277.0	-	-

[a]The 1974 projections assume a later child-bearing age than those for 1971.

[b]Assumes 2.11 fertility rate and zero annual statewide net in migration.

[c]Assumes 2.45 fertility rate and 150,000 annual statewide net in migration from 1980 to 2000.

[d]Assumes 2.45 fertility rate and 100,000 annual statewide net in migration (first prepared in 1974)

Table 12-2. California Population Growth Assumptions[a]

Growth Alternative		Fertility Rate[b]	State Net Annual in-migration, persons
C-300	High	2.780	300,000
D-150	Base	2.450	150,000
E-Zero	Low	2.110	0

[a]Source: State of California Population Estimates and Projections for Counties and WRCB Sub-basin Planning Areas 1970, 1975, 1980, 1990, 2000. Department of Water Resources, April, 1972.

[b]Refers to the terminal completed fertility rate which is the number of children born to each group of 1,000 women born in a specific year or group of years. This rate is assumed to be constant over the planning period.

Table 12-3. Population of Central Coastal Basin by County (1,000's)[a]

County	1970	1980				1990				2000			
		Department of Finance			County planning departments	Department of Finance			County planning departments	Department of Finance			County planning departments
		Low E-Zero	Base D-150	High C-300		Low E-Zero	Base D-150	High C-300		Low E-Zero	Base D-150	High C-300	
Santa Cruz	124	154	159	169	178	189	202	233	247	224	254	303	321
Santa Clara	29	72	97	127	44	114	162	223	85	137	200	275	156
San Benito	18	20	22	22	22	23	28	28	29	25	34	37	29
Monterey	249	291	304	310	303	339	368	407	375	381	430	523	466
San Luis Obispo	107	119	133	142	132	131	172	212	172	141	208	295	223
Santa Barbara	265	306	321	336	319	353	440	513	384	395	568	727	449
Total	792	962	1,036	1,106	998	1,449	1,372	1,616	1,292	1,303	1,694	2,160	1,644

[a] Small, sparsely settled portions of Kern and Ventura counties are within the Central Coastal Basin; these areas contained less than 200 people in 1970.

Fig. 12-1A AMBAG Planning Areas

Fig. 12-1B AMBAG Planning Areas

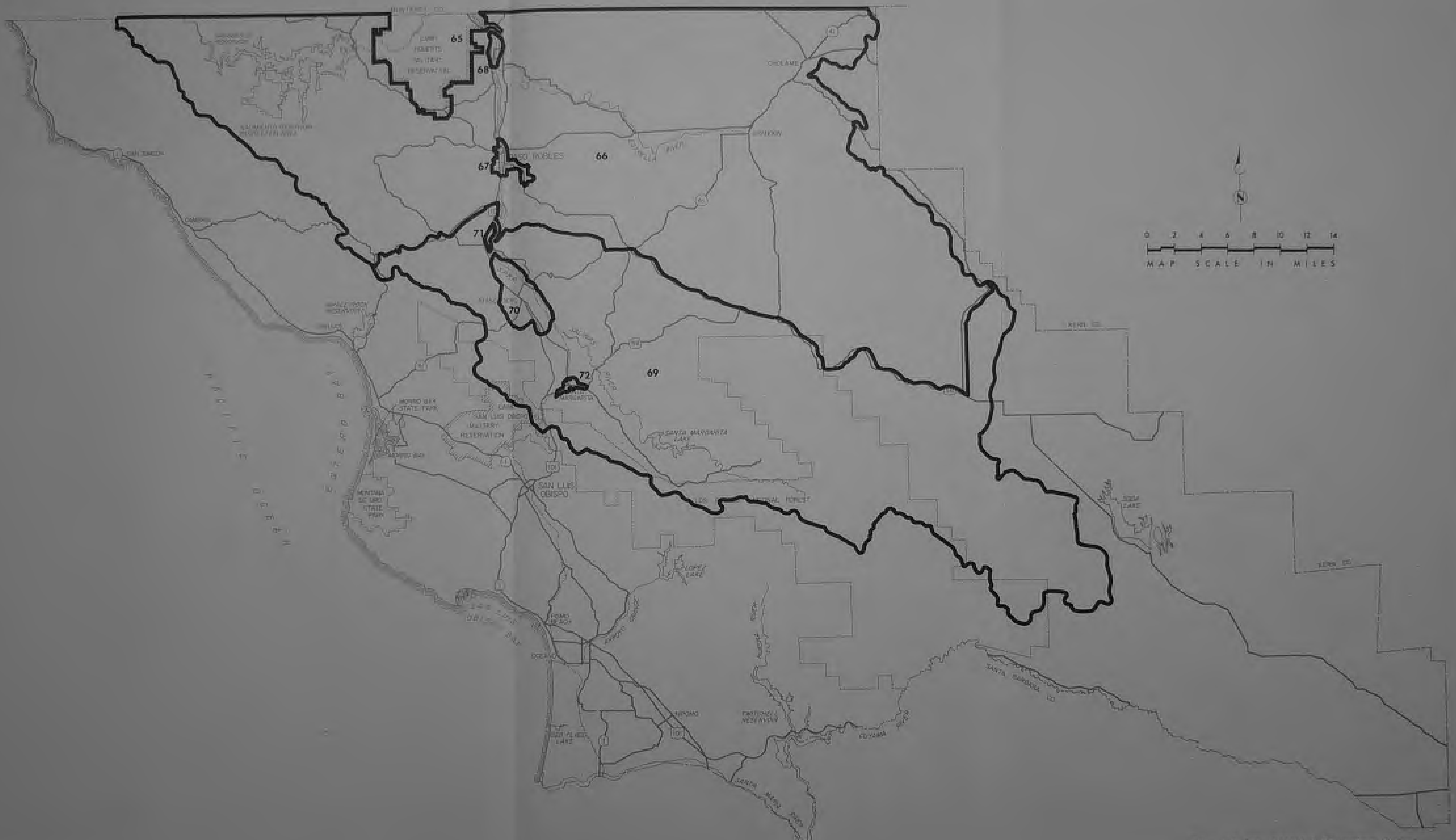

Fig. 12-1C AMBAG Planning Areas

Fig. 12 - 2 Southern Central Coastal Basin Planning Areas

Table 12-4. Population Projections by AMBAG Planning Areas[a] (State Department of Finance)

Planning area	1970	1975	1980	1990	2000
1 South County	200	250	300	400	500
2 North Coastal	923	2,270	3,970	7,270	9,070
3 Big Basin State Park					
4 Davenport	285	360	540	800	1,000
5 San Lorenzo Valley	1,935	2,100	2,350	2,900	3,600
6 City of Santa Cruz	32,056	34,600	38,400	46,300	59,800
7 Scotts Valley	4,297	5,230	6,500	9,000	11,200
8 Felton-Mt. Herman	2,228	2,430	2,640	3,400	4,200
9 Ben Lomond	2,793	3,060	3,450	4,300	5,300
10 Boulder Creek	1,806	1,990	2,250	2,800	3,500
11 North Santa Cruz	4,714	6,080	7,880	11,500	14,400
12 Soquel Uplands	5,016	4,300	4,650	5,400	6,700
13 Capitola	27,086	30,000	33,300	41,100	51,100
14 Aptos	9,099	9,680	10,700	12,800	15,900
15 La Selva Beach	1,171	1,370	1,660	2,200	2,700
16 Pajaro	4,606	5,230	6,130	7,900	9,800
17 Watsonville	24,221	27,400	31,900	40,900	51,000
74 Zayante	2,320	2,550	2,900	3,600	4,500
75 Ben Lomond Cons. Fac.	130	130	130	130	130
18 Llagas-Uvas	1,163	1,450	2,600	4,400	5,400
19 Morgan-Hill	8,933	17,400	31,300	52,100	64,700
20 San Martin	4,210	8,700	15,700	26,100	31,900
21 Gilroy	15,410	26,100	47,000	78,400	96,800
22 Diablo	126	300	540	900	1,100
30 Pajaro River	6,208	7,130	8,000	9,800	11,400
31 Pajaro S.D.	1,407	1,580	1,800	2,300	2,700
32 Castroville	6,107	7,330	9,000	13,300	15,600
33 Castroville S.D.	3,235	3,960	4,800	7,000	8,100
34 Marina	9,770	10,990	12,400	14,700	17,200
35 Fort Ord	31,128	33,660	37,000	39,400	45,900
36 Monterey-Salinas Highway	1,202	1,200	1,300	1,400	1,600
37 Salinas South	1,045	1,300	1,300	1,300	1,500
38 San Juan	6,360	9,700	12,900	17,800	20,700
39 Gabilan	698	790	900	1,100	1,300
40 Salinas	61,969	66,330	75,200	92,400	107,800
41 Toro	3,858	4,700	6,900	12,400	14,500
42 Seaside S.D.	22,200	21,380	19,300	21,600	25,200
43 Monterey	26,329	28,310	29,800	32,400	37,800
44 Pacific Grove	16,705	18,020	19,400	21,600	25,200
45 Pebble Beach	3,908	4,450	5,100	6,700	7,800
46 Carmel S.D.	9,813	9,700	10,200	11,000	12,900
47 Carmel	3,547	3,660	4,000	4,600	5,300
48 Carmel Valley	3,608	3,960	4,600	5,800	6,800
49 Coastal	755	790	800	1,100	1,300
50 Pt. Sur Naval Fac.	143	200	200	200	200
51 Pfeiffer Big Sur State Park					
52 Soledad	1,549	1,580	1,700	1,800	2,000
53 Soledad City	4,222	5,150	6,300	9,100	10,600
54 Gonzales	2,503	4,360	5,200	7,000	8,100
55 Chualar	500	1,090	1,300	1,800	2,000
56 Gonzales City	2,575	2,770	3,100	3,600	4,200
57 Soledad State Prison	2,489	2,970	3,000	3,000	3,500
58 Greenfield	1,520	1,390	1,200	1,100	1,300
59 Greenfield City	2,608	3,100	4,000	5,000	6,700
60 King City	2,151	2,740	3,300	4,200	4,900

Table 12-4. Population Projections by AMBAG Planning Areas[a] (State Department of Finance) (continued)

(2)

Planning area	1970	1975	1980	1990	2000
61 City of King City	3,717	4,200	4,700	5,700	6,900
62 San Ardo	2,044	3,040	4,000	6,700	8,000
63 San Antonio Res.-North					
64 San Antonio Res.-South					
65 Camp Roberts	0	0	0	0	0
73 Hunter Liggett	1,053	1,050	1,000	1,000	1,000
23 Aromas	1,734	1,850	2,000	2,250	2,800
24 North San Benito	1,355	1,400	1,450	1,650	2,000
25 San Juan Bautista	1,164	1,300	1,400	1,750	2,100
26 Hollister	7,663	8,800	10,100	13,800	16,900
27 Paicines	4,392	4,850	5,000	6,050	7,300
28 East San Benito	1,185	1,250	1,250	1,450	1,800
29 South San Benito	600	650	650	700	800
66 Paso Robles Div.	4,092	4,049	4,100	5,200	6,670
67 City of Paso Robles	7,168	7,455	7,900	9,090	10,800
68 San Miguel S.D.	808	796	800	810	830
69 Atascadero Div.	2,342	1,870	1,750	1,790	2,040
70 Town of Atascadero	10,290	11,780	13,370	17,225	22,190
71 Templeton	743	780	830	960	1,130
72 Santa Margarita	726	780	850	1,025	1,240
AMBAG Total	446,916	513,170	611,940	796,250	962,900

[a] Projections are for the base forecast (D-150).

Table 12-5. Present and Future Population Projections for the Southern Portion of the Central Coastal Basin

Subarea	Alternative	Population				
		1970	1975	1980	1990	2000
San Simeon	High		460	710	1,630	2,010
	Base	330	450	590	1,220	1,440
	Low		440	540	750	770
Cambria	High		2,260	2,830	4,430	5,450
	Base	2,010	2,250	2,640	3,760	4,440
	Low		2,240	2,480	2,990	3,100
Cayucos	High		2,050	2,340	4,160	5,650
	Base	1,910	2,040	2,220	2,850	3,200
	Low		2,030	2,170	2,420	2,520
Morro Bay	High		7,620	8,480	10,500	12,100
	Base	7,230	7,600	8,220	9,830	11,100
	Low		7,580	8,010	8,710	9,170
Los Osos - Baywood	High		3,890	4,330	5,470	6,100
	Base	3,690	3,880	4,200	5,080	5,650
	Low		3,870	4,090	4,470	4,670
California Mens Colony	High		5,280	5,600	6,280	6,770
	Base	5,100	5,270	5,500	6,160	6,650
	Low		5,260	5,460	5,790	6,010
San Luis Obispo	High		32,000	34,460	52,670	64,400
	Base	29,460	31,870	33,470	39,960	45,400
	Low		31,000	32,590	35,450	37,500
Avila Beach	High		960	1,190	1,880	2,170
	Base	820	950	1,090	1,600	1,730
	Low		940	1,040	1,230	1,320
Shell Beach - Pismo Beach	High		5,660	6,130	7,760	8,700
	Base	5,150	5,550	5,930	7,200	8,100
	Low		5,500	5,760	6,310	6,600
Lopez Reservoir	High		530	750	1,440	1,640
	Base	420	520	650	1,150	1,260
	Low		500	620	700	760
Soda Lake	High		1,210	2,030	4,190	6,180
	Base	920	1,200	1,780	3,360	4,650
	Low		1,170	1,490	2,130	2,690
Grover City - Oceano	High		9,340	9,790	10,990	11,800
	Base	8,890	9,300	9,630	10,760	11,700
	Low		9,200	9,530	10,100	10,520
Arroyo Grande	High		8,730	9,700	11,820	12,910
	Base	8,370	8,700	9,520	11,150	12,320
	Low		8,660	9,230	10,000	10,430
Upper Santa Maria River	High		3,930	4,750	5,970	8,560
	Base	3,850	3,910	4,260	4,680	5,880
	Low		3,960	3,870	3,880	3,890
Guadalupe	High		4,320	4,650	5,710	6,400
	Base	4,040	4,300	4,530	5,210	5,540
	Low		4,220	4,370	4,630	4,700
Santa Maria	High		57,800	68,350	111,950	179,000
	Base	54,460	57,600	65,380	103,440	146,900
	Low		57,300	61,090	74,100	86,500

Table 12-5. Present and Future Population Projections for the Southern Portion of the Central Coastal Basin (continued)

Subarea	Alternative	Population 1970	1975	1980	1990	2000
Los Alamos	High		2,120	2,510	3,750	4,320
	Base	1,820	2,100	2,330	3,170	3,320
	Low		2,060	2,220	2,520	2,650
Lower San Antonio Creek	High		780	970	1,430	1,500
	Base	690	770	880	1,220	1,270
	Low		760	860	980	1,000
Lompoc	High		37,000	39,000	59,010	78,300
	Base	34,490	36,900	38,270	53,390	65,300
	Low		35,790	36,790	42,400	47,470
Lower Santa Ynez River	High		14,150	14,210	18,100	20,370
	Base	13,940	14,100	14,140	17,690	19,790
	Low		14,050	14,100	15,500	16,400
West Santa Barbara Coastal	High		20	30	150	230
	Base	0	10	20	100	150
	Low		10	20	40	50
Gaviota	High		3,900	4,530	7,460	8,130
	Base	3,530	3,880	4,250	6,560	6,840
	Low		3,810	4,180	4,980	4,790
Buellton	High		2,470	2,650	3,970	4,900
	Base	2,380	2,460	2,570	3,600	4,250
	Low		2,450	2,520	2,890	3,090
Solvang - Santa Ynez	High		4,590	5,210	8,690	11,200
	Base	4,290	4,570	5,040	7,550	9,200
	Low		4,550	4,770	5,670	6,140
Cachuma Reservoir	High		890	1,030	1,480	1,990
	Base	760	880	980	1,270	1,560
	Low		870	930	1,040	1,130
Goleta	High		58,100	74,900	129,630	225,400
	Base	51,240	57,920	70,300	104,650	157,220
	Low		56,840	63,200	83,910	92,880
Santa Barbara	High		85,570	107,340	151,250	204,420
	Base	77,720	85,230	102,920	126,990	149,410
	Low		84,840	95,540	95,910	108,160
Montecito	High		8,330	9,600	11,700	15,290
	Base	7,750	8,300	9,050	10,600	11,640
	Low		8,170	8,300	8,450	9,400
Summerland	High		800	870	1,330	1,830
	Base	740	790	840	1,200	1,330
	Low		780	820	950	970
Carpinteria	High		11,040	17,560	35,300	40,580
	Base	9,400	11,000	13,100	20,500	23,560
	Low		10,650	10,910	16,200	19,620
Southern Central Coastal Basin Total	High		375,800	446,500	680,100	958,300
	Base	345,400	374,300	424,300	575,900	730,800
	Low		369,400	397,500	455,100	504,900

basis for making projected judgments by the State and Regional Boards. In 1974, revised projections were issued by the DOF. As indicated below, the revised projections on a statewide basis are lower than those prepared in 1971 (see Table 12-1). This is a result of decreasing net immigrations and women having babies at a later age, thereby stretching out the time between generations.

As a result of this shift to an older child-bearing age (even assuming the same cohort fertility rate), by the year 2000 there are significant reductions in the populations projected amounting to about 1.8 million and 2.1 million for series E-O and D-150, respectively.

It is readily conceded that completion of any planning process which involves a span of several years necessitates the establishment of a data base for a particular point in time, after which new data cannot be incorporated. Unfortunately, the 1974 DOF projections were too late to be incorporated into the water quality control plans as a functional element. However, these projections or (if subsequent projections are prepared by DOF) the most current forecasts will be used in updating the plans.

Being aware that the DOF demographers would from time to time revise their projections, that these revised projections might differ from the 1971 projections used, and that even at best all projections are nothing more than estimates, the basin contractors were directed to build flexibility into the plans. This flexibility was incorporated into the plans in order to minimize the effect of variations in population growth from the 1971 projections on the conceptual schemes presented in the plan.

The significance of the difference between the 1971 and 1974 projections varies between basins. Listed below is a comparison of the "baseline" (population base for recommended alternative) Series D-150 (1971) and the comparable D-100 (1974) for Basin 3.

Year	1980	1990	2000
D-100	369,500	474,800	558,800
D-150	350,600	429,500	513,100
Difference –	18,900	45,300	45,700

The biggest difference between the 1971 and 1974 projections occurs in the year 2000 and is approximately 11 percent. This variance is well within the bounds of planning flexibility, with insufficient difference to effect the conceptual nature of the basin plan, its implementation or the scheduling of construction.

It should be noted that the scope of the plan is basinwide and that the population element is critical only to the extent that it affects conceptual decisions, such as whether to consolidate facilities or whether to initiate certain water quality management actions. Also, the actual design capacity for individual wastewater facilities will be determined using the most current DOF projections at the facility level of planning.

LAND USE

Current detailed and uniform land use data for the Central Coastal Basin are limited. Two land use categories, urban and irrigated land, were delineated on 1:250,000 scale maps provided by the State Department of Water Resources. The urban category includes residential, commercial and industrial land uses.

Table 12-6 lists the present and projected urban land use in the basin, while Table 12-7 presents the same data for irrigated agriculture. Land use distributions are illustrated in Fig. 12-3A, 3B.

Less than two percent of the total AMBAG area is devoted to urban use. Although some of the finest agricultural areas in the country are found in the AMBAG area, only five percent of the nonurban area is under irrigation. Most of the remainder of the area is foothill country and rugged, mountainous terrain with little or no development. Urban development is concentrated in the coastal areas and is supported by tourism, the fishing industry and military activities and in the Santa Clara, Pajaro and Salinas valleys, by a multimillion dollar agricultural economy.

The California Department of Water Resources forecasted the increases in irrigated acreage which were further modified by the Basin Contractor. The land area under irrigation is expected to increase 17 percent by 2000 compared to an expected 25 percent increase in the area devoted to raising more than one crop annually. According to the Department of Water Resources, over 800,000 additional acres of land are suitable for irrigation in the Central Coastal Basin, far more than the projected requirements for new lands.

Table 12-6. Urban Acreage by Sub-basin

Sub-basin	Urban (1000's acres)			
	1970	1980	1990	2000
Santa Cruz (01)	0.3	0.4	0.5	0.6[a]
San Lorenzo (02)	20.8	28.0	35.0	42.0
Aptos-Soquel (03)	10.1	14.0	18.0	21.0
Pajaro (04)	18.6	55.0	90.0	125.0
Salinas (05)	35.9	44.0	53.0	62.1
Carmel (06)	12.7	16.0	19.0	22.0
Monterey (07)	0.1	0.1	0.2	0.2
San Luis Obispo (08)	12.3	13.0	13.8	14.2[b]
Soda Lake (09)	1.0	1.1	1.1	1.1
Santa Maria (10)	11.7	13.8	18.9	24.4
San Antonio (11)	1.2	1.3	1.3	1.3
Santa Ynez (12)	8.0	8.8	9.8	10.3
Santa Barbara (13)	29.3	39.2	52.7	64.7
Total	162.0	234.7	313.3	388.8

[a] Land use data for sub-basins 01-07 provided by Yoder-Trotter-Orlob & Associates. See Task Report, Task II-1, "Develop Population and Land Use Projections", September, 1971.

[b] Land use data for sub-basins 08-13 provided by Herman D. Ruth & Associates.

Table 12-7. Irrigated Acreage by Sub-basin

Sub-basin	1,000 acres			
	1970	1980	1990	2000
Santa Cruz (01)	6.0	6.5	7.1	7.3[a]
San Lorenzo (02)	0.2	0.2	0.2	0.2
Aptos-Soquel (03)	1.9	2.0	2.2	2.2
Pajaro (04)	111.1	120.5	129.6	134.5
Salinas (05)	202.3	219.8	236.7	245.6
Carmel (06)	0.5	0.5	0.6	0.6
Monterey (07)	0.4	0.4	0.5	0.5
San Luis Obispo (08)	20.3	21.6	24.2	25.0[b]
Soda Lake (09)	.2	.2	.3	.4
Santa Maria River (10)	39.7	41.7	45.4	46.3
San Antonio Creek (11)	2.9	3.0	3.3	3.4
Santa Ynez River (12)	21.8	23.2	27.0	27.9
Santa Barbara (13)	11.4	10.9	9.2	7.9
Total	418.7	450.5	486.3	501.8

[a] Data provided by Yoder-Trotter-Orlob & Associates; see Task Report, Task II-1, "Develop Population and Land Use Projections", September, 1971.

[b] Based on Department of Water Resources data.

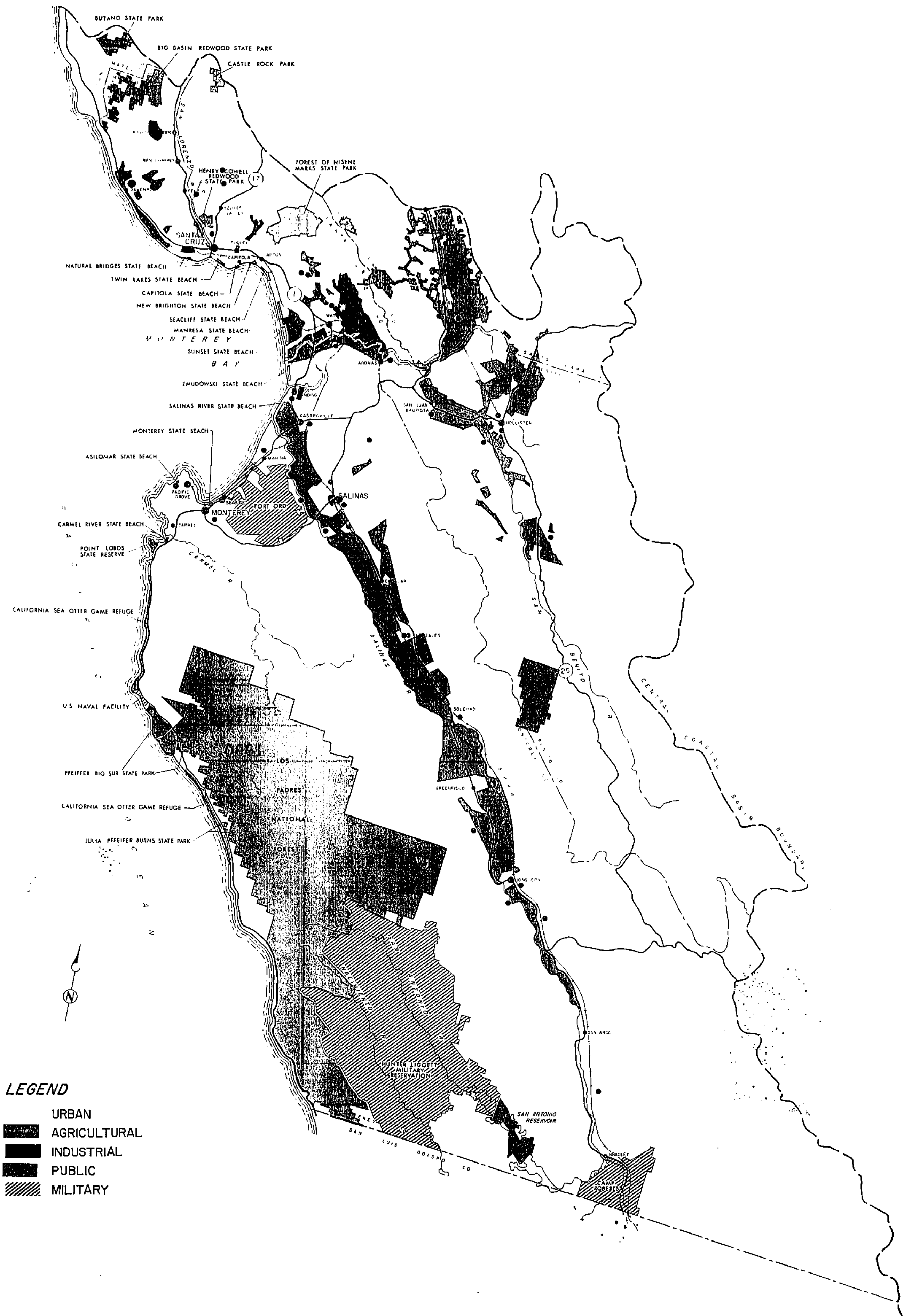

Fig. 12-3A Land Use

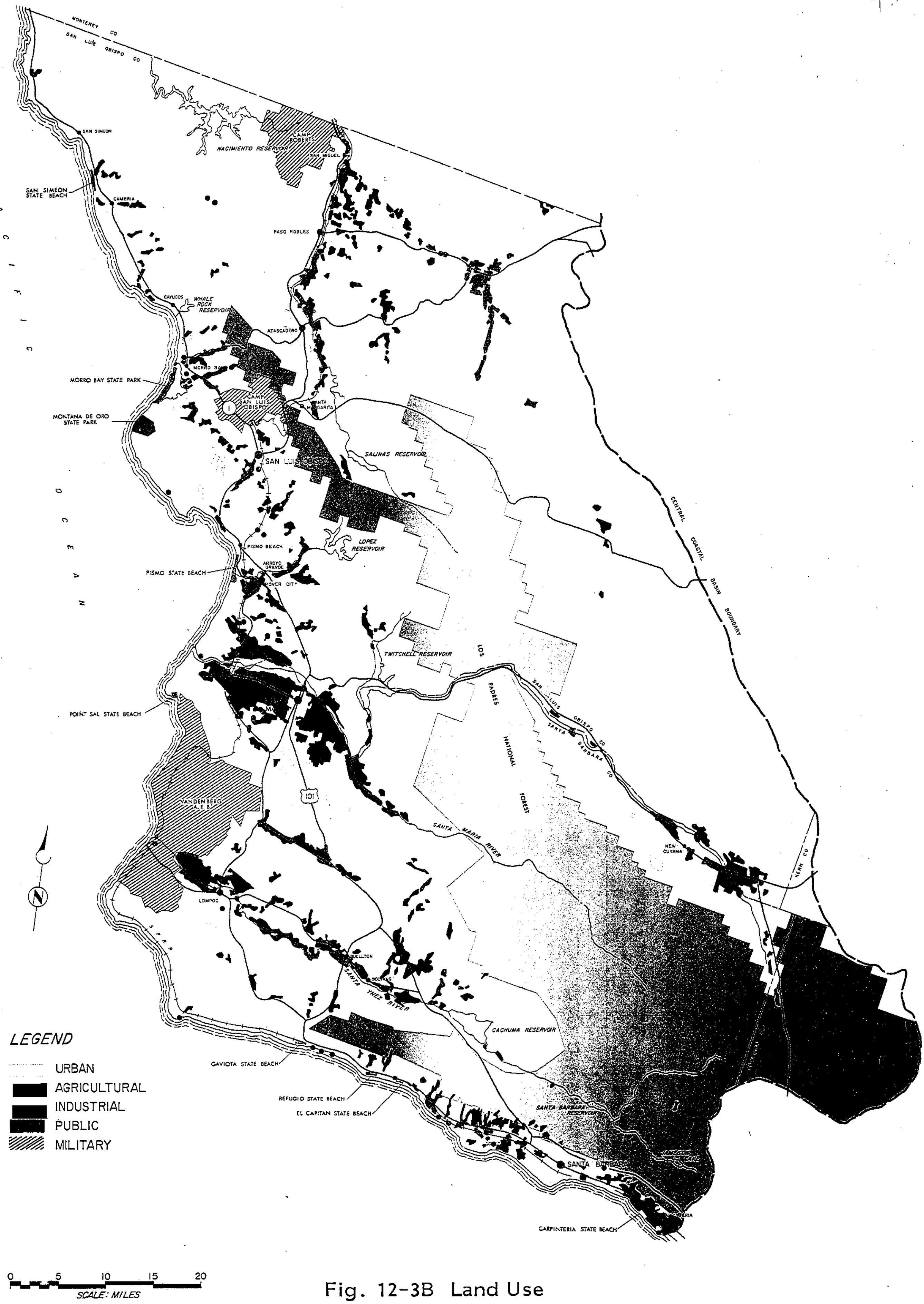

Fig. 12-3B Land Use

Table 12-8. Summary of Employment in the Central Coastal Basin

Employment	1000's persons				
	1970	1975	1980	1990	2000
Agriculture, forestry and fishing	24.5	23.7	23.0	23.1	22.3
Mining	2.1	2.1	2.1	2.2	2.2
Construction	13.1	14.9	17.3	21.7	25.9
Manufacturing	32.8	43.7	51.4	70.6	86.2
Transportation, communications, and public utilities	17.9	20.3	23.5	30.3	37.2
Wholesale and retail trade	56.1	64.2	73.6	98.2	121.6
Finance, insurance and real estate	14.8	17.1	20.0	26.4	32.7
Services	50.9	110.2	130.0	182.8	239.1
Government (including military)	52.0	55.2	59.8	67.0	64.4
Total employment	264.2	351.4	400.7	522.3	631.6

Table 12-9. Major Manufacturing Activity, Southern Central Coastal Basin Present and Projected

Location	Value of Shipments, Millions of 1970 Dollars				
	1970	1975	1980	1990	2000
San Luis Obispo County					
All manufacturing	75.1	94.6	113.4	164.5	244.1
Santa Barbara County					
All manufacturing	220.4	254.5	299.2	414.3	587.8
Food and kindred products	45.0	48.2	53.6	59.0	66.6
Printing and publishing	11.2	12.5	13.8	20.6	29.5
Machinery excluding electrical	5.2	6.1	6.9	9.2	12.5
Electrical equipment and supplies	64.5	67.7	79.3	112.9	161.3
Instruments and related products	9.2	12.1	15.4	23.1	35.5
Miscellaneous manufacturing products	8.6	11.3	14.4	21.6	33.2
City of Santa Barbara					
All manufacturing	57.2	72.0	86.4	125.3	185.9
City of Santa Maria					
All manufacturing	32.8	41.3	49.5	71.8	106.6
City of San Luis Obispo					
All manufacturing	21.6	27.2	32.6	47.3	70.2

The Department also indicates that 800,000 acres of nonirrigable land suitable for urban development remain in the Central Coastal Basin. Again, this is far more land than would be required to accommodate projected urban growth.

Land requirements for grazing and timber production in the planning area are likely to exceed the supply of lands suitable for these purposes in the near future. All other land uses can probably be met during the study period through better land management and particularly, by the multiple use of lands for activities which are compatible with one another.

The projection of both urban and irrigation uses in the southern portion of the Central Coastal Basin was based on allocation of projected increases in the counties to the various basin subareas. The apportionment of urban land acreage for future time periods considered that urban areas do not grow equally and do not grow independently of their present size. Larger urban areas tend to grow proportionally more rapidly than smaller urban areas. For each time period, the projected increase in urban area in each basin subarea was in proportion to the ratio:

$$\text{GROWTH} \propto \frac{(\text{Urban area of basin subarea})^2}{(\text{Total urban area of basin})^2}$$

In this way, larger urban areas receive a larger proportion of the projected increase in urban land area; the smaller urban areas receive a significantly smaller proportion of the urban land area. This approximate growth relationship has an empirical basis in general.

In similar fashion, the apportionment of irrigated acreages for future time periods was based on the assumption that irrigated areas will tend to increase more rapidly where there is already irrigated area.

The allocations of urban and irrigated land use, as described above, were reviewed independently. During the course of the urban land use allocation, the Santa Barbara subarea was allocated urban area equal to its total area. For the year 2000, the Santa Barbara subarea was considered completely urban.

The basin subareas were ranked according to the number of acres devoted to urban land. The rank order for each subarea remained the same for the entire 30 year period. The changes in urban land use in the basin subareas were then related to the respective changes in urban population using population density as a measure. The population density for the basin overall remained fairly constant, in the vicinity of 5.4 persons per urban acre during the years 1970, 1975, and 1980. The density increased to 5.6 for 1990 and 5.8 for 2000. There were no unusual changes in urban population density for any basin subarea, so that the urban land use allocations were considered reasonable.

Similar analyses of the irrigated land use allocations led to the same conclusions. The largest increases in irrigated land use occurred in five basin subareas: Santa Maria River, Guadalupe, Santa Maria, Lompoc, and Solvang/Santa Ynez. The first three subareas account for 81 percent of the basin increase in irrigated land area, and all five subareas account for 92 percent of the increase. The allocations were allowed to stand because these five subareas now contain nearly two-thirds of the irrigated land area and still possess adequate land available for irrigation according to Department of Water Resources' detailed analyses.

ECONOMY

The employment and overall economy of the Central Coastal area is established on a broad base. A summary of employment statistics and projections is contained in Table 12-8. The largest single job category in the basin is wholesale and retail trade with almost 60,000 jobs or 21 percent of the labor force. This category is closely followed by services and government, each of which account for about 20 percent of the labor force. The major change anticipated by the year 2,000 is an increase in the services sector to 37.8 percent of the labor force. Some of this increase will be at the expense of employment in agriculture which is expected to be reduced due to increased mechanization. Agricultural employees numbered 24,500 in 1970 or nine percent of the labor force; agricultural employment is expected to decline to 22,300 workers or 3.5 percent of the total labor force in the year 2000. Manufacturing employment is expected to triple from 32,800 in 1970 to 86,200 in 2000. During this period overall employment is expected to increase by almost 250 percent.

While the above discussion illustrates employment and economic trends in the basin, it does not describe the overall economy. Manufacturing wages paid in the five major counties in the basin equaled $550 million (1972) and taxable sales registered $1,574 million. The value of agricultural production was greater than manufacturing wages in all counties and greater than taxable sales in San Benito County. This reflects the major role of agriculture in the five counties, especially San Benito.[1]

Primary activities such as agriculture and industry utilize local goods and services to produce a product for markets outside the area. This demand for local goods and services, in turn, generates additional employment. There are demands for fertilizers, irrigation water and pesticides; machinery needs servicing, and transportation systems must be built, maintained and utilized to transport crops or the processed product to local or long distance markets. These added elements of the retail and services sector create additional local demand or economic activity. Thus, the projected growth in primary activities is very significant as it will result in greater growth in the service sector.

A more detailed analysis of manufacturing conducted for the southern portion of the Central Coastal Basin is summarized in Table 12-9.

Production output, reflected in dollar value of shipments, was used as the base. Values for counties, selected places and selected major industries were shown in the Census of Manufacturers, 1967.[2] These values were adjusted to 1970 using ratios of employment in 1970 to that in 1967, and County Business Patterns for the two years.[3] The projected values of production were obtained from projections of Indexes of Production for Selected Industries.[4] The indices for the Santa Barbara Standard Metropolitan Statistical Area were the nearest local figures, and were assumed to apply to San Luis Obispo as well as Santa Barbara County. Separate indices were used for each of the major industries shown. A composite index was used to project the "all manufacturing" industry values for counties and cities. Table 12-8 shows economic development in terms of projected value of shipments, for the major manufacturing industry groups.

Recreation is also a major segment of the economy. Mild winters, pleasant summers and picturesque rugged coast provide an unparalleled setting. Santa Cruz, Pebble Beach, Carmel, Big Sur, San Simeon, Morro Bay, Pismo Beach and Santa Barbara are just a few of the areas within the basin, nationally known for their recreational amenities. These attributes can be expected to continue to attract tourists and vacationers.

No major conflicts are anticipated between the economic growth of this area and water quality maintenance; however stricter controls over wastewater discharges will be necessary. The 1972 Federal Water Pollution Control Act Amendments call for standards for some 27 industrial dischargers. The Environmental Protection Agency has promulgated proposed effluent limitation guidelines for industries which elect to discharge independently and guidelines for pretreatment of wastes which discharge to publicly-owned treatment works. Effluent limitations imposed on discrete industrial dischargers will be described as part of the National Pollution Discharge Elimination System (NPDES). This permit procedure will be administered by the Regional Water Quality Control Board. Monitoring requirements will be incorporated in the permits covering both effluent and receiving water quality.

REFERENCES

1. California Information Almanac, 1973.

2. U.S. Bureau of the Census, Census of Manufacturers, 1967, Vol. III, Area Statistics, Part 1, Alabama-Montana

3. U.S. Bureau of the Census, County Business Patterns, California CBP-67-6 and CBP-70-7.

4. U.S. Department of Commerce, Bureau of Economic Analysis, Population & Economic Activity in the U.S. and Standard Metropolitan Statistical Areas, Historical and Projected, 1950-2020, July, 1972.

Chapter 13 Water Resources Development and Use

Surface and groundwater originating in the Central Coastal Basin have been available in sufficient quantity in the past to meet the overall water requirements of the area. Continued development of local supplies is expected to serve the water needs of the area for the next few years. Increasing urban, industrial and agricultural demands, however, will require an importation of water or a reevaluation and change in local water policies and utilization in some sub-basins.

Generally, water requirements in the coastal areas are met through surface water development on small coastal streams and from groundwater development. In the inland areas, almost all requirements are met through groundwater development. Surface water developments in inland areas have been constructed for groundwater recharge.

WATER SUPPLY DEVELOPMENT

Existing surface and groundwater resource developments within each sub-basin of the Central Coastal Basin are discussed in the following paragraphs. Data on existing and possible future reservoirs are presented by sub-basin in Tables 13-1 and 13-2. Figures 13-1A, -1B and -1C illustrate the location of present and possible future reservoirs in the AMBAG Area and Figure 13-2 locates them in the southern portion of the Central Coastal Basin. Safe yields for the groundwaters in each sub-basin are presented in Table 13-3.

Santa Cruz Coastal, San Lorenzo River and Aptos-Soquel Creeks Sub-Basins

The three small sub-basins located around the northern portion of Monterey Bay will be developed in the future to supply the municipal requirements of the Santa Cruz area. These basins are well endowed with surface runoff.

Surface Water Development

The only large reservoir which presently exists in the three Santa Cruz area basins is Loch Lomond Reservoir on Newell Creek, a tributary of the San Lorenzo River, which provides municipal supply for the City of Santa Cruz. Loch Lomond Reservoir, created by the construction of Newell Dam in 1960, has a gross storage of 8400 acre-feet and an estimated annual yield of 3750 acre-feet. Under the Santa Cruz County flood control and water conservation district proposed plan for water development, the yield of Loch Lomond Reservoir would be increased by 1975 to approximately 3750 acre-feet per year by back-pumping from the Felton pumping station on the San Lorenzo River.

Groundwater Development

It is estimated that under present conditions, approximately 9100 acre-feet is pumped from the groundwater basins in the three Santa Cruz area sub-basins. The Santa Cruz master plan envisions the ultimate development of the groundwater basins to approximately 16,100 acre-feet per year. This corresponds to the estimated safe yield of these basins. Estimated safe yield for each of the sub-basins is shown in Table 13-3.

Pajaro River Sub-Basin

The Pajaro River sub-basin includes three areas of major water use which have traditionally been considered separately when determining water balance. These three areas are the South Santa Clara Valley, encompassing the towns of Morgan Hill and Gilroy, the Hollister area and the area around Watsonville, downstream from the Pajaro Gap where the Pajaro River enters the coastal plain. Each of these three areas is primarily dependent on groundwater development. In previous publications, there is a wide range of estimates of the safe yield of groundwater basins within the Pajaro River Sub-basin. Surface water development within the sub-basin has been for the purpose of groundwater recharge and flood control. Water has been held in storage and released when conditions are favorable for percolation to the groundwater basins.

The U.S. Bureau of Reclamation has received Congressional authorization but not funding to serve the Pajaro River Sub-basin from the proposed San Felipe Division of the Central Valley Project. Details of this project are discussed below.

Surface Water Development

There are two reservoirs in the South Santa Clara Valley which control runoff for groundwater recharge. Both reservoirs are operated by the South Santa Clara Valley Water Conservation District. Chesbro Reservoir, which was constructed in 1955 on Llagas Creek, has a gross storage capacity of 7500 acre-feet and provides an average annual yield of 3800-acre-feet. Recent studies of enlarging Chesbro Reservoir have indicated that this would be uneconomical. Uvas Dam was constructed on Uvas Creek in 1957 with

Table 13-1. Existing Surface Water Development with Gross Storage Greater than 1,000 Acre-feet

Sub-basin	Reservoir and/or dam	Year completed	Owner and/or operating agent[a]	Stream	Gross storage capacity (acre-feet)	Annual yield (fps)	Project purpose[b]
02	Loch Lomond	1960	City of Santa Cruz	Newell Creek	8,400	3,750	M
04	Chesbro	1955	SSCVWCD	Llagas Creek	7,500	3,800	G, I, R
04	Uvas	1957	SSCVWCD	Uvas Creek	10,000	4,700	G, I, R
04	North Fork Dam	1939	Pacheco Pass WD	Pacheco Creek	6,200	4,050	G, I
04	Paicines	1912	SBCFCWCD	Tres Pinos Creek	4,500	-	G, I
04	Hernandez	1961	SBCFCWCD	San Benito River	18,000	5,150	G, I, R
05	San Antonio	1966	MCFCWCD	San Antonio River	350,000	32,000	A
05	Nacimiento	1957	MCFCWCD	Nacimiento River	350,000	85,000	A
05	Salinas	1942	USCE	Salinas River	26,000	5,500	G, M
06	San Clemente	1921	CAWC	Carmel River	2,200	11,200[c]	M
06	Los Padres	1949	CAWC	Carmel River	3,000		M
08	Whale Rock	1961	State of California	Old Creek	40,000	8,900	M
08	Lopez	1969	SLOCFCWCD	Arroyo Grande Creek	51,000	6,200	A
10	Twitchell	1958	USBR	Cuyama River	240,000	21,200	A
12	Jameson	1930	Montecito CWD	Santa Ynez River	6,600	1,500	M
12	Gibraltar	1920	City of Santa Barbara	Santa Ynez River	13,000	4,300	M
12	Cachuma	1956	USBR	Santa Ynez River	205,000	27,800	A
12	Alisal Creek	1971	Petan Company	Alisal Creek	2,300	-	M, R

[a] Operating agencies:

SCCFCWCD	Santa Cruz County Flood Control Water Conservation District
SSCVWCD	South Santa Clara Valley Water Conservation District
SBCFCWCD	San Benito County Flood Control and Water Conservation District
MCFCWCD	Monterey County Flood Control and Water Conservation District
USCE	United States Army Corps of Engineers
CAWC	California American Water Company
SLOCFCWCD	San Luis Obispo County Flood Control and Water Conservation District
USBR	United States Department of the Interior, Bureau of Reclamation

[b] Project purposes:

A	Multipurpose
F	Flood control
G	Groundwater recharge
I	Irrigation
M	Municipal and industrial
R	Recreation

[c] Combined yield of San Clemente and Los Padres

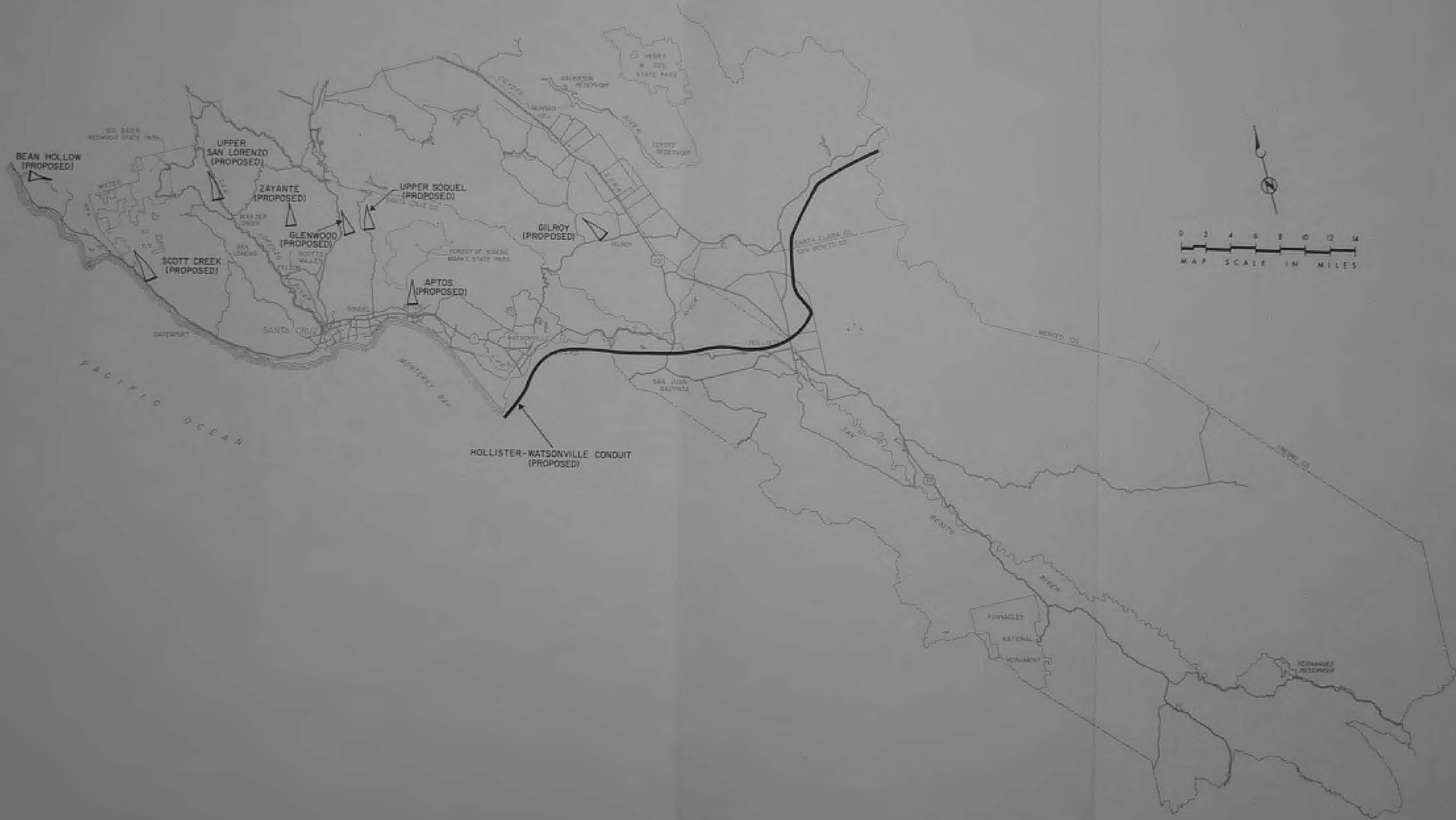

Fig. 13-1A Present and Possible Future Reservoirs in the AMBAG Area

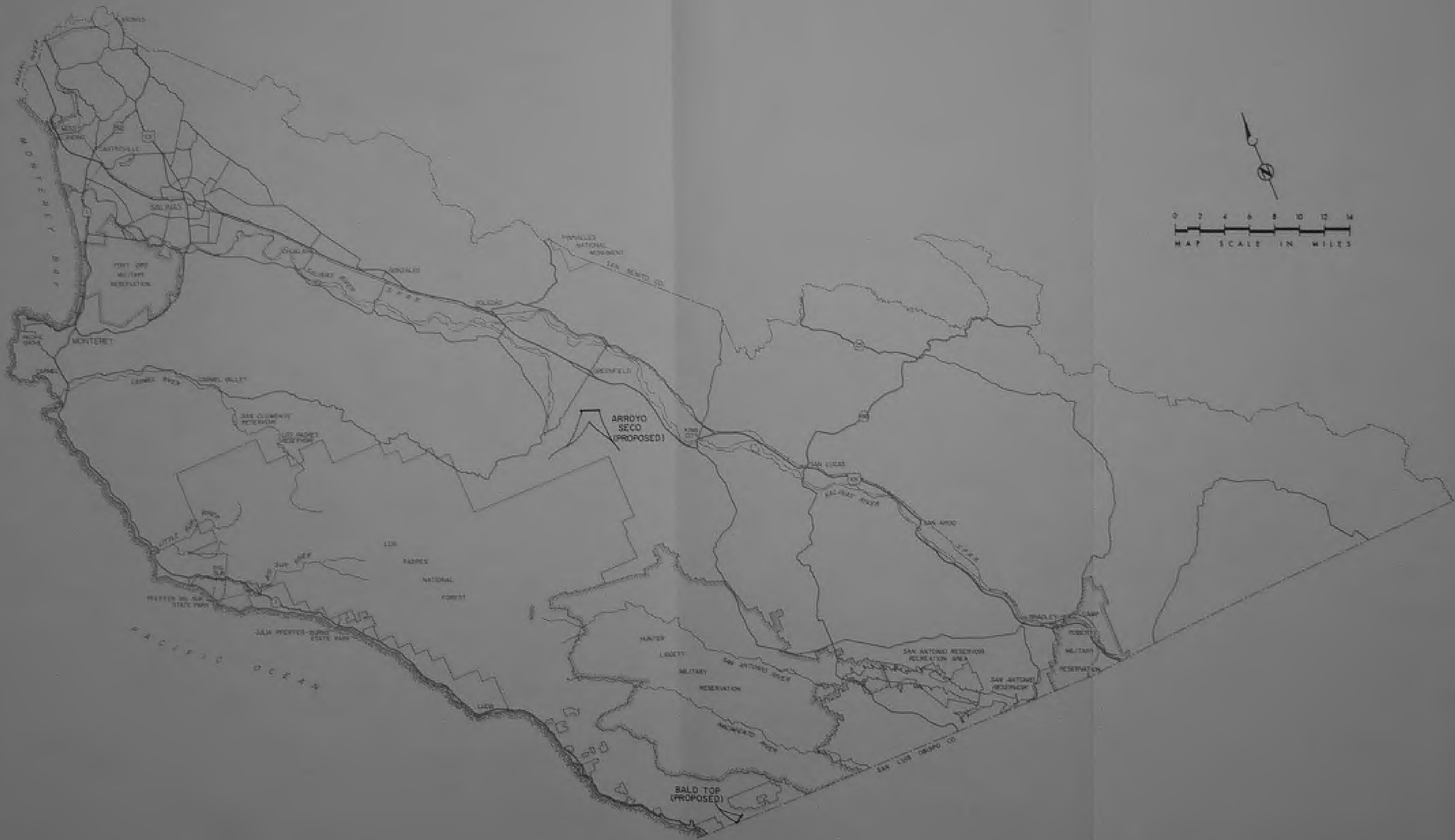

Fig. 13-1B Present and Possible Future Reservoirs in the AMBAG Area

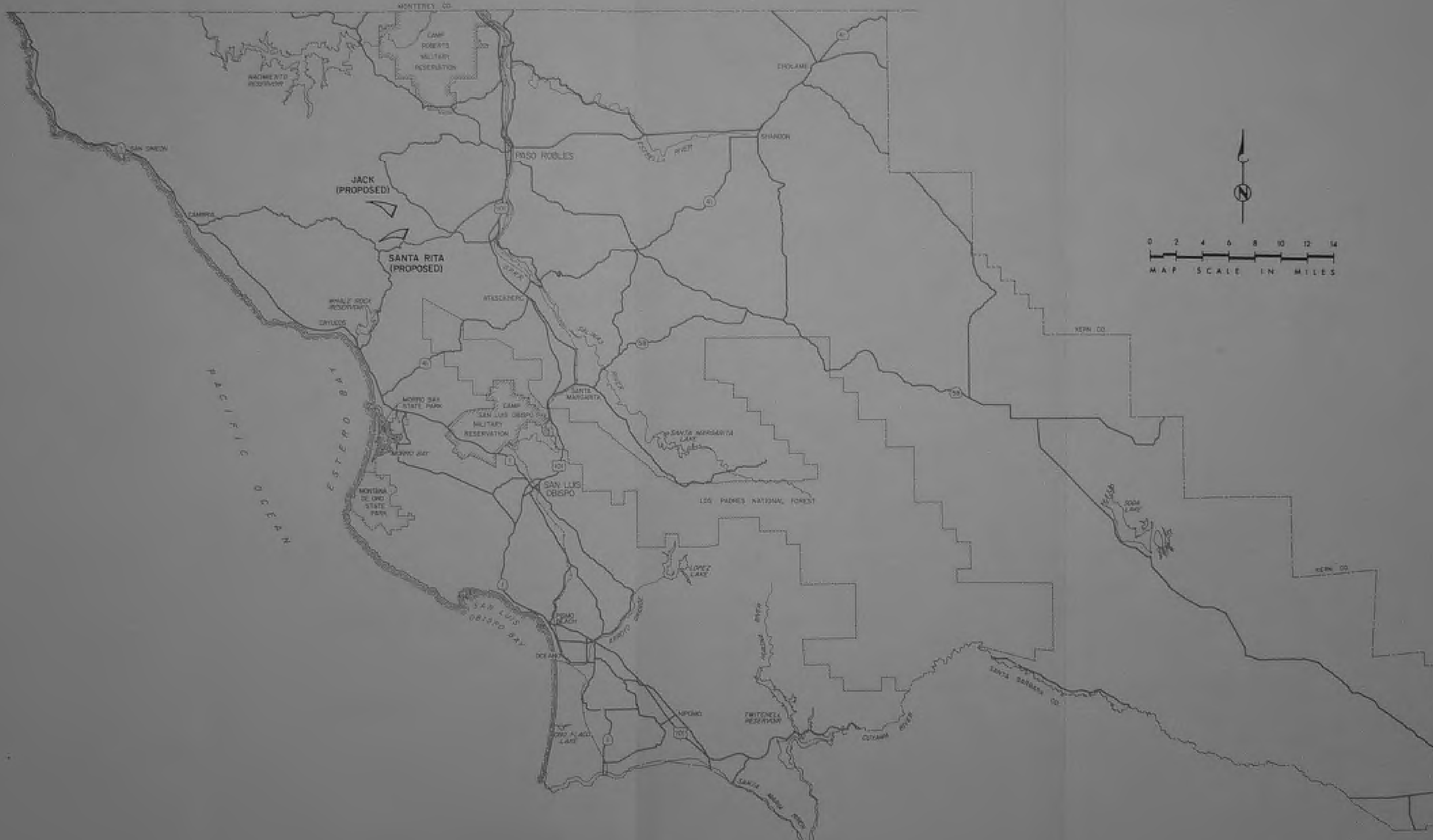

Fig. 13-1C Present and Possible Future Reservoirs in the AMBAG Area

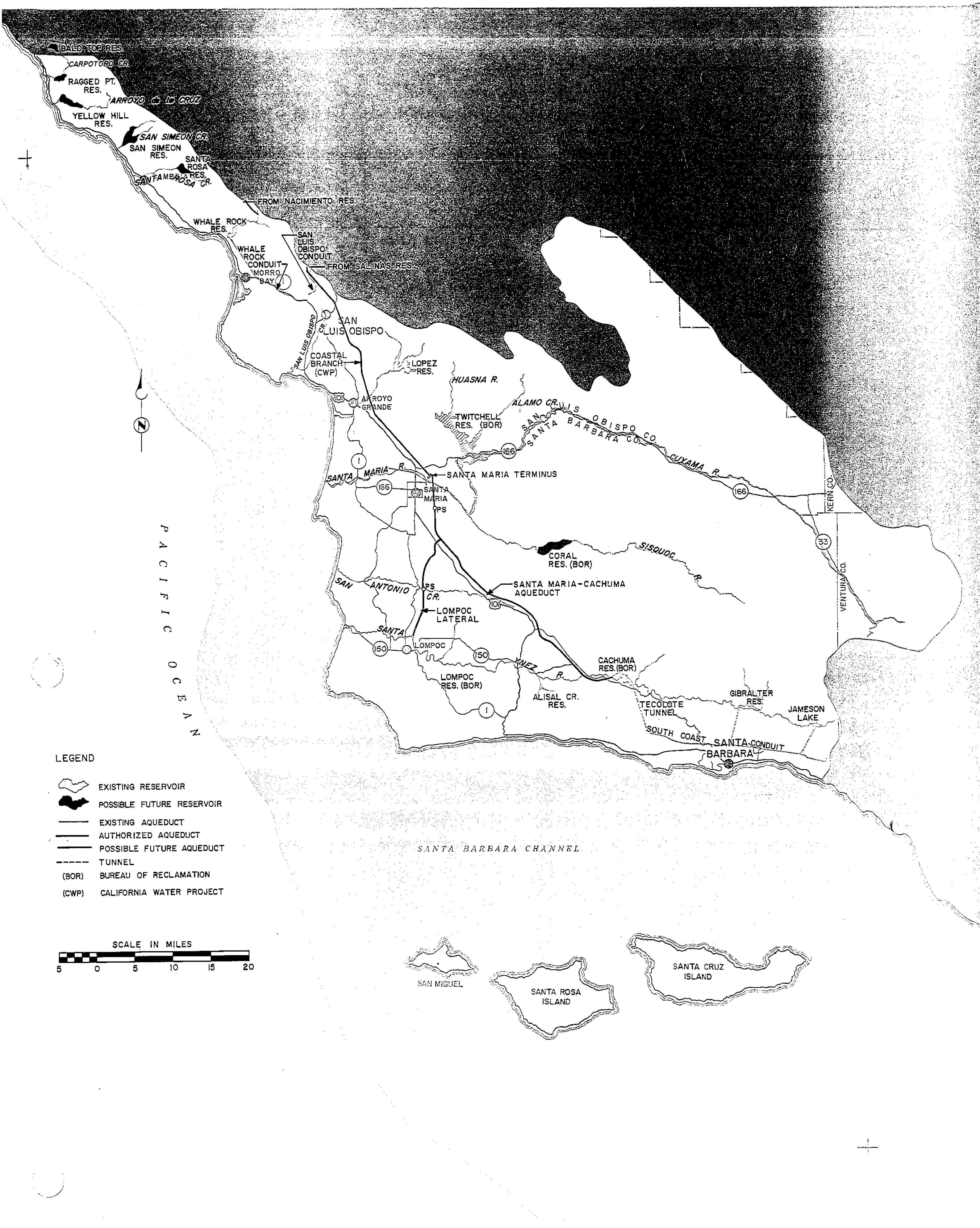

Fig. 13-2 Present and Possible Future Reservoirs in the Southern Central Coastal Basin

Table 13-2. Potential Surface Water Development with Gross Storage Greater than 1,000 Acre-feet

Sub-basin	Reservoir and/or dam	Agency proposing project[a]	Stream	Gross storage capacity (acre-feet)	Annual yield (fps)	Project purpose[a]
01	Bean Hollow	State of California	Arroyo de los Frijoles	72,500	19,600	I, M, R
01	Scott	SCCFCWCD	Scott Valley	21,000	7,200	M
02	Zayante	SCCFCWCD	Zayante Creek	15,200	4,100	M
02	Upper San Lorenzo	SCCFCWCD	San Lorenzo River	7,700	2,400	M
03	Glenwood	SCCFCWCD	W.F. Soquel Creek	11,800	4,800	M
03	Aptos	SCCFCWCD	Aptos Creek	9,000	3,500	M
03	Upper Soquel	SCCFCWCD	E. F. Soquel Creek	14,000	6,400	M
04	Gilroy Dam	USCE	Uvas	65,000	16,000	A
05	Arroyo Seco	MCFCWCD	Arroyo Seco	b	75,000	G, F
05	Jack Creek	SLOCFCWCD	Jack Creek	29,000	7,100	I, M
05	Santa Rita	SLOCFCWCD	Santa Rita Creek	22,000	6,400	I, M
08	Bald Top	SLOCFCWCD	San Carpoforo Creek	20,000	10,400	M
08	Ragged Point	SLOCFCWCD	San Carpoforo Creek	30,000	17,500	M
08	Yellow Hill	SLOCFCWCD	Arroyo de la Cruz	80,000	27,300	M
08	San Simeon	SLOCFCWCD	San Simeon Creek	60,000	18,200	M
08	Santa Rosa	SLOCFCWCD	Santa Rosa Creek	35,000	8,900	M
10	Round Corral Dam	USBR	Sisquoc River	-	6,000	F, G
12	Lompoc	USBR	Santa Ynez River	425,000	16,600	G, I, M

[a] See Table 13-1 for abbreviations.

[b] Not yet established.

a gross storage capacity of 10,000 acre-feet. Since Uvas Creek downstream from the dam traverses a confined zone of the groundwater basin, a portion of the 4700 acre-feet average annual yield from Uvas Reservoir is diverted by pipeline for release downstream from Chesbro Dam.

Groundwater Development

The estimated safe yield of groundwater basins in the Pajaro River Sub-basin under present conditions is on the order of 207,000 acre-feet per year. Total water requirements, based on applied irrigation requirements under present conditions, are on the order of 180,000 acre feet per year. Safe yield of groundwater basins in the sub-basin can be increased by future recharge activities to approximately 229,000 acre-feet per year.

All of the existing surface water development in the Pajaro River Sub-basin is for the purpose of groundwater recharge. Water is held in storage until after the end of the runoff season when percolation capacity in the streambeds becomes available.

Salinas River Sub-Basin

The Salinas Valley is the largest valley within the California coast range and has long been an important agricultural area producing specialty crops. The agricultural development of the Salinas Sub-basin is dependent on the underlying groundwater basins. The major agricultural development has occurred in the Salinas Valley north of Bradley. Approximately 150,000 acres are irrigated in the Salinas Valley. In the Upper Basin area, lying mainly in San Luis Obispo County, groundwater provides over 95 percent of the water requirements of an irrigated area in excess of 18,000 acres. It also provides the entire water requirements of San Miguel, Paso Robles, Atascadero, Garden Farms, Santa Margarita, Shandon and other smaller communities.

The major surface water developments within the Salinas River Sub-basin have been constructed for the purpose of groundwater recharge. These projects are described below.

Surface Water Development

The Monterey County Flood Control and Water Conservation District currently operates two large reservoirs on west side tributaries to the Salinas River. These reservoirs are operated to recharge the groundwater system in the Upper Valley and Forebay aquifers downstream from Bradley.

Nacimiento Reservoir, with a gross storage capacity of 350,000 acre-feet, was completed in 1957. Although the reservoir which controls the waters of the Nacimiento River is within the San Luis Obispo County, all but 17,500 acre-feet of the estimated annual yield of 85,000 acre-feet is committed to use in Monterey County. San Luis Obispo County has not yet constructed diversion facilities to utilize Nacimiento water, so that currently, almost the entire yield is available for groundwater recharge in Monterey County.

San Antonio Reservoir, which controls the flow of the San Antonio River, was completed in 1965. It has a gross storage capacity of 350,000 acre-feet and provides an annual yield of approximately 32,000 acre-feet for groundwater recharge in the Salinas River channel downstream from Bradley.

The United States Army Corps of Engineers completed Salinas Reservoir in the Upper Salinas Basin in 1942 to provide a water supply for Camp San Luis Obispo. The reservoir has a storage capacity of approximately 26,000 acre-feet. The reservoir is now operated by the San Luis Obispo County Flood Control and Water Conservation District and most of the annual yield of about 5500 acre-feet is pumped over the coastal divide to supply municipal requirements for the City of San Luis Obispo. Some releases to the Salinas River during the period July 1 to November 1 are required to meet downstream vested rights.

Groundwater Development

Nacimiento and San Antonio Reservoirs have been very successful in increasing groundwater recharge in the Upper Valley and Forebay aquifers and in increasing the safe yield of these basins. Since the Forebay aquifer is the source of water and area of recharge for the pressure aquifers, these upper basin reservoirs can, by maintaining groundwater levels in the Forebay aquifer, also be credited with maintaining the safe yield of the pressure aquifers at their historic level of about 78,000 acre-feet per year. However, evidence developed in previous studies by the California Department of Water Resources[1] indicates that transmissibility of the confined pressure aquifers limits any increase in safe yield resulting from planned recharge in the Forebay area.

In the East Side aquifer groundwater is unconfined. Pumping in this area has reversed the hydraulic gradient between the Pressure and the East Side aquifers so that poorer quality water

Table 13-3. Groundwater Resources[a]

Sub-basin		Estimated safe yield acre-feet/year
Santa Cruz Coastal (01)		6,180
San Lorenzo (02)		2,500
Aptos-Soquel (03)		7,390
Pajaro (04)		
Santa Cruz County	75,000	
Santa Clara County	92,000	
San Benito County	62,000	
Total		229,000
Salinas (05)		
Pressure Area	78,000	
East Side	19,000	
Forebay	161,000	
Upper Valley	78,000	
Upper Basin	47,300	
Total		383,300
Carmel (06)		6,000
Monterey Coastal (07)		1,100
San Luis Obispo Coastal (08)		21,300
Soda Lake (09)		600
Santa Maria River (10)		83,000[b]
San Antonio (11)		7,000
Santa Ynez (12)		45,700
Santa Barbara Coastal (13)		19,700

[a] Estimated yields from miscellaneous sources; see accompanying text for discussion of sources and variations in yield estimates.

[b] Groundwater yield estimates for the Santa Maria Valley vary; lower figures have been reported.

from the Pressure aquifer is now moving into the East Side aquifer. Projects proposed to ameliorate this condition are discussed in the final section of this chapter.

Carmel River Sub-Basin

Municipal and industrial water requirements in the Carmel River Sub-basin, including the Monterey Peninsula, are supplied primarily by the California American Water Company. The company operates two reservoirs in the Carmel River Basin conjunctively with the groundwater basin to supply water of excellent quality to its system.

The two reservoirs which the company operates are both on the Carmel River. San Clemente Reservoir, constructed in 1921, has a storage capacity of 2200 acre-feet. Los Padres Reservoir, constructed upstream from San Clemente Reservoir in 1959, has a storage capacity of 3000 acre-feet. The combined yield of the two reservoirs is estimated to be 11,200 acre-feet per year, a portion of which is direct diversion. In recent years, the company has diverted an average of about 10,000 acre-feet per year from the two reservoirs.

The California American Water Company or the U.S. Army Corps of Engineers may increase the height of San Clemente Dam within the next 15 years to provide an additional yield of about 25,000 acre-feet. The company has estimated that the Carmel River has a developable yield on the order of 40,000 to 50,000 acre-feet per year, which is more than sufficient to meet projected demands in the sub-basin through the year 2000.

Monterey Coastal Sub-Basin

There are no major water development projects in the Monterey Coastal Sub-basin and none are anticipated during the study period. The area had a population of about 1600 in 1970 and population projected for the year 2000 is on the order of 3,000. The major area of population concentration is Carmel Highlands at the very north of the sub-basin. Carmel Highlands is served by the California American Water Company from its water projects in the Carmel River Sub-basin. Elsewhere in the sub-basin water supply is obtained from springs, small surface diversions and groundwater. Groundwater in most of the area is very limited. Water supply in the Big Sur area is pumped from alluvium and gravels along the river. The Big Sur River is the largest drainage basin in the area and has been designated an "extraordinary scenic waterway" under the California Protected Waterways Plan. Projected annual water requirements for the sub-basin in the year 2000 are less than 1000 acre-feet.

San Luis Obispo Coastal Sub-Basin

North of San Luis Obispo, the groundwater resources and demands are essentially in balance. By 1980, an anticipated increase in population will result in a need for supplemental water. This requirement will probably be met by import of water from the Salinas River Sub-basin and/or from the Coastal Aqueduct of the State Water Project.

Similar circumstances exist in the San Luis Obispo-San Luis Obispo Creek area. Present demands are met by groundwater reservoirs plus surface storage and diversion. Whale Rock and Salinas Reservoirs supply approximately 75 percent of the water requirement in the area. Supply and demand are presently balanced but a modest growth in agriculture and a significant growth in population will require additional water resources.

Water supplies in the sub-basin south of San Luis Obispo are adequate to meet all present and future demands through the study period. Groundwater is supplemented with surface diversions from Lopez Reservoir.

Surface Water Development

Lopez Reservoir in the south coastal area of San Luis Obispo County stores the waters of Arroyo Grande and Lopez Creeks. The reservoir was completed in 1969 and is operated by the San Luis Obispo County Flood Control and Water Conservation District. It has a storage capacity of 51,800 acre-feet and an estimated annual yield of 6,230 acre-feet. About 1700 acre-feet per year is released to the stream channel for groundwater recharge, and the balance of the yield is available for conveyance to the cities of Arroyo Grande, Oceano, Grover City, Pismo Beach and Avila Beach for municipal and industrial use.

Whale Rock Reservoir on Old Creek was completed by the California Department of Water Resources in 1961. The reservoir has a gross storage capacity of 40,000 acre-feet. The reservoir is operated by the Whale Rock Commission of the California Department of Finance, to supply municipal requirements for the City of San Luis Obispo, California Polytechnic College, and the California Mens Colony. The Department of

Water Resources estimated the annual yield of Whale Rock Reservoir prior to construction at approximately 8,900 acre-feet. More recent estimates of Whale Rock yield are somewhat less than 4,000 acre-feet per year.[2]

The City of San Luis Obispo receives the major portion of the yield of Salinas Reservoir, which is located in the upper Salinas Basin. Salinas Reservoir, with a gross storage capacity of 26,000 acre-feet, was completed in 1942 by the United States Army Quartermaster Corps to provide a water supply for Camp San Luis Obispo. The estimated annual yield from Salinas Reservoir is 5,500 acre-feet.

Groundwater Development

The San Luis Obispo Coastal Sub-basin has in the past relied heavily on groundwater development to meet water demands, and groundwater basins will continue to meet a portion of water demands during the study period.

In the area north of Cayucos, the County Master Plan forecasts total water requirements in the year 2000 on the order of 4,500 acre-feet per year with a groundwater safe yield on the order of 1,880 acre-feet per year.

In the Central Coastal Area, from Villa Creek drainage south to Los Osos Drainage, maximum groundwater safe yield is on the order of 7,000 acre-feet per year. The Master Plan forecasts total requirements in this area in the year 2000 of about 16,000 acre-feet per year.

In the San Luis Obispo Bay Area, including the city of San Luis Obispo, groundwater safe yield is estimated at 2,250 acre-feet per year. In the Arroyo Grande area, groundwater safe yield is estimated at 8,500 acre-feet per year. There are indications that groundwater basins in the Arroyo Grande area are currently being overdrafted.

Soda Lake Sub-Basin

The Soda Lake Sub-basin, also commonly known as the Carrizo Plain area, is the largest closed interior basin within the California Coast Ranges. The sub-basin receives sparse rainfall, averaging about eight inches per year.

There are no existing or potential surface water projects in the Soda Lake Sub-basin. Existing water requirements in the sub-basin, amounting to less than 1,500 acre-feet per year are supplied by individual wells. Ground water in the sub-basin is of generally poor mineral quality, especially in the eastern portion. Further development and water requirements in the Soda Lake Sub-basin are not expected to increase significantly in the future.

Santa Maria River Sub-Basin

The Santa Maria River Sub-basin includes the Santa Maria and Cuyama Valley and a large coastal plain on which the city of Santa Maria is situated. The sub-basin is primarily dependent on groundwater, and surface water has been developed to increase groundwater recharge.

Surface Water Development

In 1958, the United States Bureau of Reclamation completed the construction of Twitchell Dam on the Cuyama River about six miles upstream from the confluence of the Cuyama and Sisquoc rivers which form the Santa Maria River. The Santa Maria and Cuyama rivers form the boundary between San Luis Obispo and Santa Barbara counties. Twitchell Reservoir has a gross storage capacity of 240,000 acre-feet; 89,000 acre-feet are reserved for flood control storage. The estimated average annual yield of Twitchell Reservoir is 21,200 acre-feet. Water stored in the reservoir is released downstream after the rainy season to recharge the groundwater basin in the Santa Maria Valley.

Groundwater Development

Groundwater storage in the Cuyama Valley is replenished primarily by natural percolation from the Cuyama River. Average annual natural recharge is estimated to be on the order of 13,000 acre-feet. Safe yield, including recharge from irrigation return flows, is estimated to be on the order of 15,000 acre-feet per year. Groundwater quality in the Cuyama Valley is only fair, and water from deep wells is the most highly mineralized. Current consumptive use of groundwater in the Cuyama Valley is estimated to be on the order of 35,000 acre-feet, exceeding the estimated safe yield by 20,000 acre-feet.

The Santa Maria Valley groundwater basin under current conditions of augmented recharge from Twitchell Reservoir is estimated to have a safe yield on the order of 70,000 acre-feet per year.

It is estimated that current consumptive use of groundwater in the Santa Maria Valley exceeds safe yield by approximately 39,000 acre-feet. It is estimated that previous overdraft has depleted groundwater storage above sea level from about 3,000,000 acre-feet to a current estimated 1,800,000 acre-feet. Exploitation of stored groundwater in the Santa Maria Valley is expected to continue in the future.

San Antonio Creek Sub-Basin

The San Antonio Creek Sub-basin encompasses the small 211 square mile coastal drainage basin of San Antonio Creek, lying between the Santa Maria and Santa Ynez River basins. There is no existing major surface water development in the sub-basin, and none is anticipated during the study period.

Groundwater development in the sub-basin provides a water supply for irrigating approximately 3,000 acres. Vandenberg Air Force Base pumps about 2,000 acre-feet annually from the groundwater basin. The estimated safe annual yield of the groundwater basin is on the order of 7,000 acre-feet. At the present time water supply and use within the basin are considered to be essentially in balance. Present groundwater storage reserves are expected to be adequate to meet increased demands during the study period. The U. S. Bureau of Reclamation has forecasted demand in the sub-basin in the year 2000 only 400 acre-feet greater than present use.

Santa Ynez River Sub-Basin

The Santa Ynez River Sub-basin trends westerly, parallel to the Santa Barbara reach of the Pacific Coast from which it is separated by the Santa Ynez Range. Substantial surface water development has occurred within the sub-basin, primarily to supply municipal requirements in the Santa Barbara Coastal Sub-basin. Within the sub-basin there has been substantial groundwater development, especially in the area around Lompoc. Additional surface water storage is planned, with conjunctive operation of surface and groundwater storage.

Surface Water Development

Juncal Dam, forming Jameson Lake, was constructed on the upper reaches of the Santa Ynez River in 1930 to supply the Montecito County Water District in the Santa Barbara Coastal Sub-basin. The reservoir has had a considerable reduction in storage capacity due to siltation. Its present capacity is estimated to be about 6,600 acre-feet and estimated annual yield is on the order of 1,200 acre-feet. The yield from Jameson Lake is conveyed to Montecito County Water District, which lies just to the east of the city of Santa Barbara, via Doulton Tunnel through the Santa Ynez Mountains. Seepage into Doulton Tunnel provides an additional yield of about 300 acre-feet.

Gibraltar Dam was constructed on the Santa Ynez River in 1920 by the city of Santa Barbara, and its capacity was increased in 1949 to 15,600 acre-feet. Continuing siltation has reduced the storage capacity to a presently estimated 13,000 acre-feet. Under present conditions safe annual yield from the reservoir is on the order of 3,500 acre-feet. Water from Gibraltar Reservoir is conveyed through the Santa Ynez Mountains via Mission Tunnel, where seepage provides an additional yield averaging about 800 acre-feet per year.

The Petan Company has just recently completed Alisal Creek Dam on Alisal Creek which is tributary to the Santa Ynez River at Solvang. The reservoir has a storage capacity of approximately 2,300 acre-feet. Yield from the reservoir will be used to supply recreation and residential development on the Alisal Ranch.

The United States Bureau of Reclamation constructed Cachuma Dam in 1953 on the Santa Ynez River downstream from Gibraltar Dam. Cachuma Reservoir had a storage capacity of 205,000 acre-feet at the time it was constructed. The estimated yield of Cachuma Reservoir has recently been revised by the Bureau, and is currently estimated at 28,400 acre-feet per year including seepage in Tecolote Tunnel. About 90 perecent of the yield of Cachuma Reservoir is exported through Tecolote Tunnel to the Santa Barbara Coastal Sub-basin and is supplied to portions of all areas along the Santa Barbara County Coast from the Goleta County Water District, east. Within the Santa Ynez River Sub-basin, the Santa Ynez River Water Conservation District has a contractual entitlement from the Cachuma Project of 2,900 acre-feet per year. This water is released downstream to the Santa Ynez River when conditions are favorable for percolation to the groundwater basin.

Groundwater Development

There has been considerable groundwater development in the Santa Ynez Valley, both for irrigation and for municipal supply for the communities of Los Olivos, Santa Ynez, Solvang, Buellton and Lompoc. Although there has been extensive surface water development in the Santa Ynez River Sub-basin, more than 90 percent of reservoir yields are diverted to the Santa Barbara Coastal Sub-basin. The remaining reservoir yield, amounting to about 2,900 acre-feet, is used for groundwater recharge in the Santa Ynez River Sub-basin and is delivered for municipal supply to the communities of Los Olivos, Santa Ynez and Solvang. Estimated present use of water in the Santa Ynez River Sub-basin is on the order of 48,000 acre-feet per year, and most of this supply is pumped from groundwater. Estimated safe yield of groundwater basins in the Santa Ynez River Sub-basin is on the order of 46,000 acre-feet per year.

Santa Barbara Coastal Sub-Basin

Groundwater in the Santa Barbara Coastal Sub-basin was developed early to meet the predominately agricultural demands. Requirements quickly outstripped local supply and the Santa Ynez River System, on the other side of the Santa Ynez Mountains, became the major source of supply.

Surface Water Development

The major portion of the water supply requirements in the Santa Barbara Coastal Sub-basin are currently being supplied from surface water storage in the Santa Ynez River Sub-basin. Water is diverted from Jameson, Gibraltar and Cachuma Reservoirs through tunnels in the Santa Ynez Mountains to the Coastal Sub-basin. It is estimated that total yield available to the Coastal Sub-basin from the Santa Ynez Reservoirs and tunnel seepage is around 30,600 acre-feet per year. The United States Bureau of Reclamation has estimated that conjunctive operation of Cachuma Reservoir with coastal groundwater basins would provide an additional yield on the order of 2,000 acre-feet per year.

Groundwater Development

Estimated safe yield of groundwater basins in the Santa Barbara Coastal Sub-basin is on the order of 19,700 acre-feet. The United States Bureau of Reclamation has estimated net water use in the coastal Sub-basin under the 1970 conditions is approximately 41,000 acre-feet per year, including approximately 13,000 acre-feet used for irrigation.

WATER DEMANDS

Data concerning the past and present water use in the Central Coastal Basin were obtained from information supplied by the California Department of Water Resources, and published reports from various other state agencies.[3-7] Where necessary these data have been updated to reflect current population and land use figures. The past and present water use data have been divided into urban, agricultural, and recreational categories for the purposes of this report. The phrase urban water use as used herein refers to both municipal and industrial water use and includes residential, commercial, governmental, institutional, and all industrial uses. Agricultural water use includes all nonurban and non-recreational water uses within the study area. Recreational water use includes the use of water by the persons in attendance at the recreational areas throughout the basin.

In order to estimate the water use requirements for the Central Coastal Basin for the period 1970 through 2000, it was necessary to evaluate the economic, environmental, ecological and sociological factors which may effect water use within the basin. The unit water use figures for the urban water demand areas have been adjusted based upon estimates of population trends, industrial and commercial development, and expected changes in the socio-economic status of the area. Projections of agricultural water demands were adjusted based upon estimates of future food and fiber requirements, the amount of irrigable land required to meet these needs, and expected changes in general farming practices. Projections of recreational water use involved the development of unit water demands based on extensive investigations and measurements by the California Department of Parks and Recreation.

Urban Water Use

The water supply for the Central Coastal Basin is provided by 72 large water systems (200 or more service connections) serving a population of approximately 705,100 people in 1970, and 430 small water systems (under 200 service connections) serving a population of approximately 27,200 people principally in camps, trailer parks and small communities scattered throughout the basin. Of the 72 large water systems, 61% of the systems are served by groundwater alone, and 11% of the systems are served by surface water alone. The remaining twenty systems (28%) are served by a combination of surface water and groundwater sources.[4]

Groundwater alone supplies 40% to 58% of the present urban water demand in the basin. Surface water sources satisfy approximately 7% to 9% of the urban water demand, and combined sources furnish approximately 35% to 51% of the total urban demand. The present urban demands that are supplied by groundwater, surface water, or combined sources are shown in Table 13-4 for each county within the basin.

Average monthly and average annual urban water use for the Central Coastal Basin for the period 1961-65 is presented in Figure 13-3. The figure shows the average annual unit water use to be 148 gallons per capita per day (gcd) for this period of time. The average annual per capita water use from this basin was the third lowest value for the state when compared with the other fifteen basins. The average 1960-65 population of the Central Coastal Basin was 640,000 persons and the total urban water use for the basin amounted to 106,000 acre-feet per year.

The present (1970) total urban water use for the Central Coastal Basin is approximately 167,000 acre-feet per year. The present urban water use for each of the six sub-basins in the southern portion of the Central Coastal Basin was calculated using the present unit water use value above and the allocated population for each sub-basin, assuming that the total population in each sub-basin will be served by a water utility or similar agency. Similar data in the AMBAG portion of the Central Coastal Basin were developed with information provided by the major water purveyors in that area.

Table 13-5 summarizes the total present urban water use by sub-basin. It is recognized that unit water use varies significantly within the basin, a factor which must be at least partly responsible for the large difference in unit water use values obtained by the Department of Water Resources for 1960-65 and 1970. A review of unit use factors indicates average gross water use ranges from 140 to 350 gallons per capita per day; net water use estimates have also been made to attempt to approximate in home uses for wastewater volume estimates, these vary from 64 to over 250 gallons per capita per day from information available. Water balance calculations must attempt to estimate both net and gross water use in order to differentiate between quantities of water which may be used to irrigate lawns and sewered wastewater.

Future Urban Water Use

In certain cases long term trends of increasing per capita urban water use have been stopped or reversed. This situation exists frequently in manufacturing and industrial areas, where technology has found ways of reducing the dependency of particular processes on water. As population densities increase in urban areas, the associated greenery decreases, and a lower per capita water use figure results.[3] Where water quality is poor due to excessive hardness domestic water use is often low for economic reasons, since water softening costs increase with total use. Where home water softeners are common, individuals become more aware of water conservation measures since excessive use increases the need and frequency of regeneration of ion-exchange resins. As water quality is improved through water supply changes or treatment, the per capita demand will rise unless water conservation measures are instituted.

There are various ways to encourage water conservation measures, including public awareness programs, encouraged use of water saving devices and inverse water rates. But in water short areas where special measures have been taken to upgrade water quality, it is reasonable to expect water agencies and consumers to recognize that water use should be regulated strictly such that high per capita use is discouraged. In areas where natural water of good quality is particularly scarce and where water is upgraded at high local cost, a strict water conservation policy should include a water rate structure which provides the economic incentive to curb excessive water use which the home water softener had originally provided. An example of such an inverse rate structure imposed by a water agency in an area where water supply improvements eliminated the need for water softeners is provided in Fig. 13-4. This district currently averages 50 gallons per capita per day water use.

It is difficult to estimate the effect of water conservation policies on the one hand, and the tendency for increased unit demands on the other. Although there are ways to discourage wasteful use of water by water rate structures, these are local decisions. Accordingly urban water use estimates are based on slight increases in per capita use over the 1970 level.

Using the allocated population projections and estimated water unit use factors, the total urban water use for each sub-basin was computed for 1980, 1990 and 2000. Table 13-5 gives the present and projected water use projections for each sub-basin by decade for the period 1970-2000.

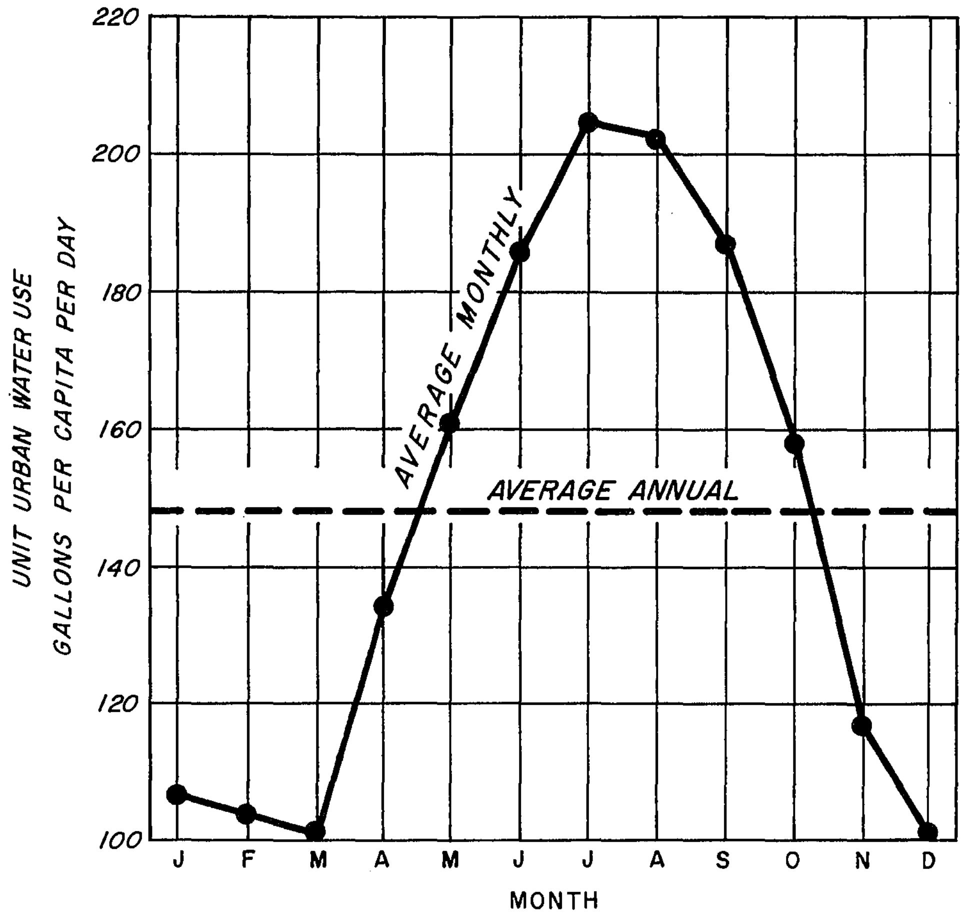

Fig. 13-3 Average Annual and Monthly Urban Water Use in the Central Coastal Basin

Table 13-4. Percent of County Populations Served by Groundwater and Surface Water Supplies[a]

County	Groundwater systems		Surface water systems		Combined groundwater and surface water systems	
	Population served, percent of County total	Water use[b] range, percent of County total	Population served, percent of County total	Water use[b] range, percent of County total	Population served, percent of County total	Water use[b] range percent of County total
Monterey	47	46 - 57	0	0	53	43 - 54
San Benito	100	100	0	0	0	0
San Luis Obispo	40	33 - 49	24	29 - 42	36	22 - 25
Santa Barbara	35	29 - 33	6	8 - 12	59	59
Santa Clara	100	100	0	0	0	0
Santa Cruz	24	20 - 31	1	1 - 4	75	66 - 79

a Includes large (over 200 service connections) public water supply systems - data from California Department of Public Health, Task Report No. B (DPH), September, 1972.
b The amount of water supplied by each source usually differs from year to year if more than one source is available.

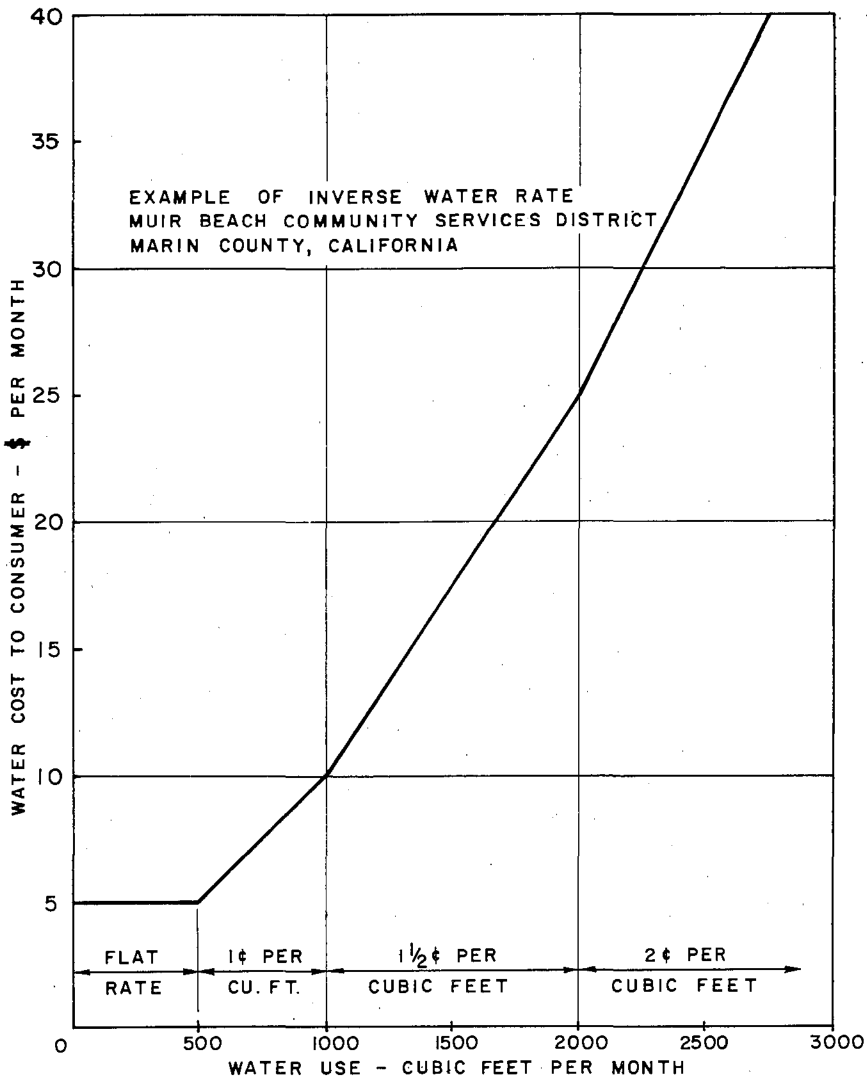

Fig. 13-4 Example of Inverse Water Rate

Table 13-5. Present and Projected Future Urban Water Use (Acre-feet/Year)

Area/sub-basin	Year			
	1970	1980	1990	200
AMBAG[a]				
Santa Cruz Coastal (01)	310	980	1,690	2,110
San Lorenzo (02)	11,110	14,050	17,660	22,490
Aptos-Soquel (03)	6,440	7,580	9,250	11,500
Pajaro (04)	14,950	30,710	46,680	57,460
Salinas (05)	42,640	53,390	66,410	78,510
Carmel (06)	12,260	14,130	16,110	18,790
Monterey Coastal (07)	190	210	270	300
Southern Portion[b]				
San Luis Obispo Coastal (08)	16,793	18,257	20,323	21,700
Soda Lake (09)	211	389	679	890
Santa Maria River (10)	14,222	17,000	21,529	25,300
San Antonio Creek (11)	573	748	1,043	1,300
Santa Ynez River (12)	12,789	14,205	16,288	17,700
Santa Barbara Coastal (13)	34,433	46,645	72,026	99,900
Total	166,921	218,294	289,960	356,860

[a] Base information supplied by major water purveyors.

[b] Based on unit urban water use factors of 205 gcd for present use, 209 gcd for 1980, and 213 gcd for 1990 and 2000.

Agricultural Water Use

As reported in the Interim Water Quality Control Plan for the Central Coastal Basin, the present agricultural water demand for the entire basin totals 1,040,000 acre-feet per year.[8] This figure was obtained by multiplying the unit water use for each type of crop grown in the basin by the total number of acres devoted to raising that particular crop, and totaling the water use figures for each type of crop. A weighted mean value of unit water use was used in cases where multiple cropping techniques were employed.

At present the amount of irrigated land in the Central Coastal Basin is approximately 350,000 acres. On an average basis, the use of 1,040,000 acre-feet annually amounts to a unit agricultural water use factor of 2.97 acre-feet per year per acre. The present total agricultural water use for the southern portion of the basin was calculated using 1970 allocated irrigated land areas and a unit agricultural water use factor of 2.97 acre-feet per year per acre. Agricultural water use in the AMBAG area was computed by multiplying applied water factors for six crops times the acreage of the crops in each sub-basin. It was assumed that these factors would remain the same through the year 2000. Table 13-6 presents the total present agricultural water use by sub-basin for the Central Coastal Basin.

The projected future water use requirements for agriculture within the Central Coastal Basin have been determined by the California Department of Water Resources from estimates of the need for food and fiber products, the resulting crop patterns and the acreages needed for each type of crop for the period 1980 through 2000.[5] Expected technological advancements in the agricultural industry were taken into account in making these estimates. The established unit water use factors for each type of crop was then used together with the projected acreage of each crop to yield the total agricultural requirements for the basin. According to the Department of Water Resources, the unit water use is expected to increase from 2.97 acre-feet per year per acre to 3.16 acre-feet per year per acre by the year 2000. These state projections of future agricultural water use have been utilized for purposes of evaluating basin water balance; it is recognized that water use will vary with cropping patterns and that the unit water use factors cited are only typical for certain crops. In the Santa Ynez and Cuyama Valley higher unit water use ranging to 5 feet per acre per year can be expected for sugar beets, alfalfa and irrigated pasture whereas lower unit values (less than 2.0 acre-feet per acre per year)would be expected for irrigated grain; in the south coastal area and the Santa Maria and Lompoc Valleys, lower values are reported for grapes and tomatoes whereas strawberries and some truck crops such as celery range above the typical values of 2.97-3.16 used for projecting basin wide demand. There is a trend in the area toward greater development of citrus, avocado and wine grapes, all of which are lower water using crops; the Santa Maria, Lompoc and south coast areas average 1.2-1.7 acre-feet per acre per year for these crops. Much of this added acreage is expected in hillside areas and could result in a higher total irrigated acreage than estimated in Chapter 14; however the influence on total water demand will not be so substantial since a shift toward these crops will probably decrease average unit water demands.

Using the allocated irrigated land areas for each sub-basin and the estimated agricultural water use factors explained above, the projected agricultural water requirements for each sub-basin in the southern portion of the Central Coastal Basin were determined by decade for the 1980-2000 period as presented in Table 13-6. Water use factors for the sub-basins in the AMBAG area were developed and, together with the projected agricultural land use, were used to project agricultural water requirements. Adjusted for return flow, these figures also appear in Table 13-6.

Recreational Water Use

A recreation matrix indicating the land and water acreage corresponding to recreation activities and available facilities for each of the recreation areas identified in the Central Coastal Basin was prepared by the State of California Department of Parks and Recreation.[9] Available data indicate a basin-wide range of unit water use from 10 gcd for day-use facilities, to 50 gcd for overnight-use with trailers. Table 13-7 lists the total present recreational water consumption for each sub-basin within the Central Coastal Basin.

It is anticipated that the total recreational attendance for the total Central Coastal Basin by year 2000 will be greater than 47 million user-days. The attendance projections are based upon the assumption that when the attendance at an individual recreation area goes beyond the carrying capacity of the existing area or facilities, additional acreage and/or facilities will be developed to meet the increased demand. Table

Table 13-6. Present and Projected Future Agricultural Water Use (Acre-feet/Year)

Sub-basin	Year			
	1970	1980	1990	2000
Santa Cruz Coastal (01)	6,850	7,430	8,050	8,300
San Lorenzo (02)	235	255	275	285
Aptos-Soquel (03)	2,130	2,310	2,500	2,580
Pajaro (04)	161,100	174,535	187,875	195,000
Salinas (05)	540,501	586,500	632,000	655,895
Carmel (06)	1,375	1,490	1,620	1,670
Monterey Coastal (07)	1,100	1,200	1,300	1,330
San Luis Obispo Coastal (08)	44,500	45,700	46,800	47,800
Soda Lake (09)	1,000	1,000	1,000	1,000
Santa Maria River (10)	152,200	175,900	184,700	194,100
San Antonio Creek (11)	11,800	12,300	12,600	12,900
Santa Ynez River (12)	69,100	73,600	75,800	78,100
Santa Barbara Coastal (13)	38,000	39,600	40,600	41,600
Total	1,029,891	1,121,820	1,195,120	1,240,760

Table 13-7. Present and Projected Future Recreational Water Requirements (Acre-feet/Year)

Sub-basin	Year			
	1970	1980	1990	2000
Santa Cruz Coastal (01)	50.41	64.97	79.53	94.09
San Lorenzo (02)	60.49	96.33	134.42	168.02
Aptos-Soquel (03)	54.89	73.93	95.21	114.25
Pajaro (04)	33.60	45.93	58.25	70.57
Salinas (05)	88.49	123.23	156.82	185.94
Carmel (06)	3.36	41.45	52.65	63.85
Monterey Coastal (07)	62.73	107.53	150.09	190.42
San Luis Obispo Coastal (08)	253.00	347.00	469.00	561.00
Soda Lake (09)	0.04	0.05	0.06	0.07
Santa Maria River (10)	38.80	50.80	67.00	80.40
San Antonio Creek (11)	7.21	9.40	12.40	14.90
Santa Ynez River (12)	67.80	114.00	228.00	358.00
Santa Barbara Coastal (13)	101.00	131.00	173.00	208.00
Total	821.82	1,205.62	1,676.43	2,106.51

[a] Source: California Department of Parks and Recreation, Basin Recreation Water Use and Waste Loads, Task 3, March, 1972.

13-7 presents the projected recreational water use within the Central Coastal Basin for each decade between 1980 and the year 2000.

Total Water Use

Within the Central Coastal Basin, gross water use including urban, agricultural, and recreational uses totaled 1.2 million acre-feet per year in 1970 and is expected to increase to 1,606,000 acre-feet per year in the year 2000. See Table 13-8 for estimated sub-basin water demand totals for 1970, 1980, 1990 and the year 2000.

In the AMBAG Area the Salinas Valley is expected to exert the greatest demand for new water supplies. Over 50 percent of the total water demand in the AMBAG planning area presently occurs in the Salinas River Valley, from San Ardo downstream to Monterey Bay. A 35 percent increase in water requirements from 1970 to 2000 is anticipated for this area. The greatest percentage increase in water demand in the AMBAG area is forecasted to occur in Santa Cruz County; projections indicate a 55 percent increase from 1970 to 2000. Essentially all of the increase in water use in the Salinas Valley is expected to go toward increasing the agricultural output of the region. Most of the increase in Santa Cruz County will be to meet the demands of new urban development. Other areas within the planning area where substantial increases are forecast are the Pajaro Valley area for intensified agricultural activity and the South Santa Clara Valley for new urban development.

The area distribution of gross total demand for water in the Central Coastal basin is shown in Table 13-8.

In the southern area it is evident that the Santa Maria River Sub-basin will continue to exert the greatest annual water demand through the year 2000. The urban increase in the percent of total water used in Santa Barbara Coastal Sub-basin suggests that the urban water use in that area will be an increasingly important water demand.

Based on the above figures, it is apparent that there will be a continuing increase in the need for water supplies to meet demands for the various water uses. Presently a major portion of the total water supply of the Central Coastal Basin is derived from groundwater sources. One method of conserving the groundwater resources of the basin would be to recharge the groundwater basins with reclaimed water either from municipal wastewater or possibly from urban or nonurban storm runoff. In addition, in some areas such as the Arroyo Grande area and the Morro Bay area, there is a potential hazard of salt water encroachment into the fresh water aquifers. This situation may also be relieved by constructing salt water intrusion barriers using reclaimed wastewaters. Highly mineralized waters present in some streams during low flow periods could be contained to prevent percolation to groundwaters; salt routing techniques could be used to dilute and flush such mineralized waters during subsequent wet periods. Areas where such water quality control programs should be considered include streams such as Poncho Rico which carry naturally degraded water into the Salinas River System. This stream and others flowing from the Gabilan Range are highly mineralized; the impact of these streams should be considered in a water quality management program.

WATER BALANCE

As population growth and expansion of agricultural, industrial and recreational activity increase, greater demands will be placed on the limited water resources of the Central Coastal Basin. Some areas are clearly water deficient and will require water importation or more comprehensive water management policies to maintain a proper balance between demand and supply. Quantity is an obvious factor; however water quality factors are also involved.

Total water use for the entire basin is expected to increase by 33% from 1970 to 2000. (There are plans to build surface storage facilities to increase the safe yield of those supplies in Santa Clara, Monterey, San Luis Obispo and Santa Barbara Counties, but these projects will not meet the expected increased demand.)

Total water use is the total amount of water used at least once. For example, the total amount of water applied to irrigated land or the total amount provided to households are components of the total water use. Net water use, on the other hand, is the amount of water consumed during use. For example, the amount of water taken up by plant tissue plus the amount lost to evapotranspiration comprise the net irrigation water use. Net agricultural water use estimates account for evapotranspiration.

Because total water use includes a varying amount of recycled water, a comparison of supply and

Table 13-8. Total Water Demand (Acre-feet/Year)

Sub-basin	Year			
	1970	1980	1990	2000
Santa Cruz Coastal (01)	7,210	8,475	9,820	10,504
San Lorenzo (02)	11,406	14,401	18,069	22,943
Aptos-Soquel (03)	8,625	9,964	11,845	14,194
Pajaro (04)	176,084	205,291	234,613	252,531
Salinas (05)	583,226	640,013	698,567	734,591
Carmel (06)	13,638	15,662	17,783	20,524
Monterey Coastal (07)	1,353	1,518	1,720	1,820
San Luis Obispo Coastal (08)	61,600	64,300	67,500	70,100
Soda Lake (09)	1,200	1,400	1,700	1,900
Santa Maria River (10)	166,500	193,000	206,300	219,500
San Antonio Creek (11)	12,400	13,000	13,700	14,200
Santa Ynez River (12)	81,900	87,900	92,300	96,200
Santa Barbara Coastal (13)	72,600	86,200	112,800	141,700
Total	1,197,742	1,341,124	1,486,717	1,600,707

Table 13-9. Estimated Net Total Water Use (1,000 Acre-feet/Year)

Sub-basin	1970	1980	1990	2000
Santa Cruz Coastal	0.7	0.8	0.9	1.4
San Lorenzo	8.9	11.3	14.2	18.1
Aptos-Soquel	5.6	6.6	8.0	10.0
Pajaro	80.1	93.0	105.4	110.3
Salinas	280.4	316.8	328.3	342.9
Carmel	10.8	12.4	13.6	16.0
Monterey Coastal	0.8	0.9	0.2	0.2
San Luis Obispo Coastal	41.7	43.4	45.6	47.3
Soda Lake	0.7	0.7	0.8	0.9
Santa Maria River	104.7	120.8	128.6	136.1
San Antonio Creek	7.9	8.3	8.6	8.9
Santa Ynez River	50.1	53.7	55.7	57.9
Santa Barbara Coastal	55.5	67.6	91.4	117.0
Total	647.9	736.3	801.3	867.0

demand must be based on a comparison of net water use to the safe yield of surface and groundwater reservoirs. Net urban water use estimates should account for effluent reuse and groundwater contributions from wastewaters.

"Safe yield" is the quantity of water that can be withdrawn from a groundwater basin or reservoir on an average annual basis without impairing the quality or diminishing the available quantity of water indefinitely into the future. Theoretically, if the net use exceeds the safe yield, then the water level in the groundwater basin on the reservoir will decrease until water quality is degraded by infiltration of inferior quality waters or until pumpage can no longer be sustained. Safe yield estimates are computations of rainfall, pumpage rates, and water table levels averaged over many years and are often conservatively low.

An estimate of net water demand was made in order to permit evaluation of water balance in the sub-basins. Total annual urban water use was assumed to be 50% from in home uses which could contribute wastewater flow and 50% as lawn watering, car washing and other outside water uses. Where municipal wastewater is returned to the ground or to surface streams at locations remote from the ocean or where in-stream percolation is encouraged, the net water use was computed as 40 percent of gross water use; where municipal wastewaters are discharged to the ocean or estuaries, the net water use was assumed to be 90 percent of gross water use. In the southern portion of the Central Coastal Basin, agricultural water use was assumed as 65 percent lost as evapotranspiration and 35 percent recoverable as some form of drainage or percolation in areas where drainage potentially could be reused in the basin. In the AMBAG area, net agricultural water use was determined by subtracting return flows from applied water demands, both of which were calculated for six crop categories for which field data were available. Estimates of net water use were made recognizing the wastewater disposal method currently being practiced in each basin; in the case of the Salinas River Sub-basin an allowance for change in disposal practice was considered. The City of Salinas discharge was assumed to be changed from its present location in the Salinas River to the ocean beginning in 1980. Where reclamation is possible and feasible in coastal areas such as around Monterey Bay and Santa Barbara, the net water use estimates for the future are probably conservative. Net water use estimates are provided in Table 13-9.

Within the AMBAG area the existing water resource probably exceeds present water use by 50 percent.

From Table 13-9, the net water use for the AMBAG area (the first seven sub-basins) amounts to about 387,000 acre-feet annually for 1970 conditions and is projected to increase to about 500,000 acre-feet by the year 2000. Total available water supplies, in terms of safe yield, are estimated to be on the order of 650,000 acre-feet annually. While the totals for the AMBAG area show a water surplus, there are existing local water supply problems and, unless additional yield is developed, these problems will intensify.

Water supplies in the Santa Cruz Coastal Sub-basin greatly exceed estimates of net use. An annual use of less than 1,000 acre-feet occurs in this sub-basin which is estimated to have a safe yield of 6,000 acre-feet.

The San Lorenzo River Sub-basin appears to be out of balance with an estimated net use of about 9,000 acre-feet in 1970 compared to a safe yield of a little more than 6,000 acre-feet. By the year 2000, the deficit would widen to about 12,000 acre-feet annually.

The Aptos-Soquel Creeks Sub-basin shows a safe yield in excess of net use in 1970 but by the year 2000 the sub-basin would be out of balance with a projected use of 10,000 acre-feet compared to a safe yield of 7,400 acre-feet. Groundwater provides the water supply in this sub-basin and presumably the basin would go into an overdraft condition by 1990.

The Pajaro River Sub-basin shows a safe yield of about 230,000 acre-feet compared to a net use of 110,000 acre-feet projected for the year 2000. Nevertheless, the San Felipe Project is designed to serve this area with supplemental water. This apparent annual oversupply might be partially explained by the uncertainty of safe yield estimates coupled with local areas where groundwater basin overdrafting is occurring.

Water supplies in the Salinas River Sub-basin appear to be sufficient to offset water demands throughout the entire planning period. A safe yield of 383,000 acre-feet compares to a projected use of 343,000 acre-feet in the year 2000. However, as in the Pajaro River Sub-basin, there are local problems evidenced by groundwater quality problems attributable to overdrafting. The East Side area is already overdrafted and the use in the

Upper Valley area is nearly equal to the safe yield of the basin.

The Carmel River Sub-basin appears to be secure in that a safe yield of 17,000 acre-feet compares to a net use of about 11,000 acre-feet in 1970. However, there is serious concern at this time that the Monterey Peninsula area water demands are already equivalent to the capacity of the water supply system serving the peninsula. Again, local supply-versus-demand relationships come into consideration. The peninsula system relies primarily on the yield of conservation projects on the Carmel River which were constructed in 1921 and 1949.

The Monterey Coastal Sub-basin appears to be in balance. An estimated safe yield of 1,100 acre-feet compares to a net use of 900 acre-feet projected for the year 1980.

Overall the southern portion of the Central Coastal Basin is an area of water need; available water supply totals approximately 240,000 acre-feet per year which slightly exceeds the Department of Water Resources' use estimate of 223,200 acre-feet per year for 1968. Net water use estimated for 1970 conditions was about 260,000 acre-feet per year and is projected to reach approximately 370,000 acre-feet per year by the year 2000. A water deficit of at least 100,000 acre-feet per year is apparent and most probably should be placed in the 200,000-250,000 acre-feet per year range to permit improvement of degraded water quality conditions in the basin groundwaters. It should also be emphasized that groundwater yield estimates are not precise.

It can be shown that the current net water use in most sub-basins is approaching if not exceeding the safe yields. The Santa Maria River Sub-basin, which includes the Cuyama Valley, and the Soda Lake Sub-basin are currently over-using or "mining" their water resources and may expect a degradation of water quality in the future as well as increased costs for pumping.

For example, the groundwater resources of the Santa Maria River Sub-basin are in the range of 79,000-83,000 acre-feet per year as a safe yield. Net water use as computed by the Department of Water Resources was 103,800 in 1968; independent net water use estimates made during the basin planning work were 104,700 acre-feet per year in 1970 and 136,100 acre-feet per year by the year 2000. Clearly the Santa Maria area is in an overdraft condition which will worsen in the future.

Continued degradation of the naturally mineralized groundwater quality can be expected until such time quality impairs use sufficiently to either reduce pumping or force development and importation of new supplies. Water reclamation is currently practiced in the Santa Maria Valley where mineralized wastewaters are returned to the land; this is helping the water balance conditions, but excessive salinity of these municipal effluents aggravates the mineral buildup problem.

The San Luis Obispo Coastal area is out of balance if net water use and water supply estimates are correct. The estimated water supply is 37,100 acre-feet per year which is less than the estimated net use of 41,700-47,300 projected from 1970 to the year 2000.

The Santa Ynez River Sub-basin as a whole is more nearly in balance with an available water resource of 45,000-50,000 acre-feet per year to meet an estimated net demand of 50,000-60,000 acre-feet per year. However, the lower Santa Ynez-Lompoc area is a watershort area, since the greatest water demand is here while the water resources are more abundant upstream.

Estimates of net water use in the Santa Barbara Coastal area project a serious imbalance for the Santa Barbara Coastal area. Present water supply yield is approximately 50,000 acre-feet per year; although estimated net water use is 55,000 acre-feet for 1970, this is projected to more than double by the year 2000.

The problem of inadequate water quantity could be alleviated for a time by recycling; however an adverse salt balance in many groundwater basins is likely to further degrade water quality. Advanced wastewater treatment methods, such as denitrification and demineralization, or exportation of poorer quality waters are some methods that are available to assist in reversing an adverse salt balance.

Increased waste loads due to increased growth will have an effect on water quality; however, the effect of non-point sources such as agricultural irrigation and the resulting concentration of salts in drainage is viewed as a more important problem than municipal waste effluent loadings. Salt contained in municipal waste effluents will continue to be a problem, particularly in the

Santa Maria-Santa Ynez areas so long as water softener brines are returned to municipal sewers. Although increased growth does increase waste loads, it is believed that growth will have a more serious effect on water balance and groundwater mineral quality than on quality of surface waters.

SOURCES OF SUPPLEMENTAL SUPPLY

Possible future sources of water supply to the Central Coastal Basin include imported water, weather modification, watershed management, groundwater basin management, development of local surface runoff, desalination, and reclamation of municipal and industrial wastewater. It should be emphasized that more efficient use of existing water resources within the basin, as for example by industrial recycling, by coordination of water use among local agencies, by conjunctive operation of surface storage and groundwater basins and by pricing policies which reflect economic value of water, should be carefully considered. The following is a summary of the options available, followed by a discussion of proposed state and federal projects.

Wastewater Reclamation and Reuse

As discussed above, water balance considerations for some sub-basins clearly require new water source development or increased reliance on wastewater reclamation. Many inland areas can effect reclamation and reuse through land disposal techniques emphasizing groundwater recharge or partial substitution of wastewater effluents for local irrigation supplies. Coastal areas will find total reclamation more difficult, and it is anticipated that the more intensively urbanized areas, such as the Santa Barbara Coastal area, will be limited to seasonal irrigation reuse on such areas as golf courses, parks, and freeway medians. Where agricultural areas are sufficiently close to wastewater treatment facilities, arrangements could be made to substitute wastewater effluents for local irrigation supplies. This may require additional treatment and institutional arrangements to effect such reuse; the Goleta vicinity is one area which could pursue seasonal use of reclaimed wastewater as water is clearly becoming a scarce resource in this area. There is local interest in irrigation reuse using wastewater from the Monterey Peninsula area for crops in the lower Salinas River area near Castroville, although alternative water supplies are also available for development.

Weather Modification

Cloud seeding operations within the Coastal Sub-basin have been carried out in the past in Santa Barbara County and increases in precipitation have been claimed. Evaluation of the effectiveness of cloud seeding, however, has been generally inconclusive. Seasonal weather patterns over the basin are such that cloud seeding operations cannot be considered a significant factor in providing additional water supplies.

Watershed Management

Because of ecological problems and costs associated with manipulation of watershed vegetative cover, watershed management is not considered a feasible means of providing any substantial additional water supplies within the Southern Central Coastal Basin during the study period.

Groundwater Basin Management

Conjunctive operation of surface storage and groundwater basins within the Southern Central Coastal Basin has been successfully practiced within recent years. The major surface reservoirs in the basin are dedicated to storing winter runoff for release when conditions are favorable for percolation to the groundwater basins from the downstream natural stream channels. Additional reservoirs are planned within the basin partially for the purpose of groundwater recharge.

In some areas conjunctive management could take a reverse pattern wherein highly mineralized waters are stored during low flow periods to prevent their percolation in recharge areas downstream. Wet season dilution and salt routing will provide benefits to groundwater quality.

When projects are constructed in the future for import of water to the Southern Central Coastal Basin, consideration should be given to utilizing capacity not required for direct deliveries in the initial years of project operation to importing high quality water for groundwater recharge. Conditions in the Santa Maria River Sub-basin may be particularly favorable for this type of operation.

Development of Local Surface Runoff

In much of the Southern Central Coastal Basin, substantial development of surface water has already occurred. Existing projects have been discussed previously. There is potential for future surface water development in the northern portion of the San Luis Obispo Coastal Sub-basin. However, it is unlikely that development will occur during the study period since alternate ources of supply are less costly.

Desalination

The California Department of Water Resources and the Federal Office of Saline Water have proposed the construction of a 35,000 acre-feet per year capacity desalting plant in San Luis Obispo County in conjunction with Pacific Gas and Electric Company's Diablo Canyon Nuclear Power Plant. Congress has failed to provide the funding for Federal participation and the Department of Water Resources will not construct the project alone. Pacific Gas and Electric is proceeding with construction but the possibility of adding a desalination plant is not eliminated. The desalination portion is designed so it could be constructed after the power plant. Escalation of power costs, a lack of participation by the OSW, and recent technological advantages with the reverse osmosis process of desalination all indicate a lack of feasibility for a desalination plant in conjunction with the Diablo Canyon Nuclear Power Plant.[10]

State and Federal Projects

Both the State and Federal Governments have been authorized to construct surface water transport systems to import water into the Central Coastal Basin. The U.S. Bureau of Reclamation's San Felipe Division of the Central Valley Project would deliver water to the Pajaro River Sub-basin and the Santa Clara Valley north of the Central Coastal Basin. The Department of Water Resource's Coastal Aqueduct of the State Water Project is designed to deliver water to the San Luis Obispo Coastal and Santa Maria River Sub-basins with local distribution systems serving the Santa Barbara Coastal Sub-basin.

San Felipe Division

The original feasibility Report for the San Felipe Division was completed in 1963. Since that time Congress has authorized the project and allocated some planning funds. Federal legislation, appropriating construction funds, will be needed by 1974 to meet the Bureau's target date of 1980 for initial deliveries. Full deliveries are scheduled for 2020.

It was initially proposed that the San Felipe Division divert an average of 298,000 acre-feet annually from San Luis Reservoir through a ten-mile long tunnel under Pacheco Pass. A recent reevaluation of water demand indicates this figure may be too high and diversions are now set at 216,200 acre-feet per year.

At the Pacheco Pass tunnel outlet, a canal to the north with a peak capacity of about 330 cfs would run along the east side of South Santa Clara Valley approximately 27 miles to deliver water to Coyote Afterbay. Here, Coyote Pumping Plant would lift water into Anderson Reservoir on Coyote Creek for storage. The Santa Clara Canal also would have a pumping plant about three miles downstream from the tunnel outlet. Water from the Santa Clara Canal would supply the South Santa Clara Valley portion of the Pajaro River Sub-basin from Morgan Hill to south of Gilroy. The 43 mile long Hollister-Watsonville Conduit, with an intake capacity of 315 cfs, would deliver water in the Hollister area and through the Pajaro Gap to the Watsonville area. Average annual deliveries envisioned under full project operating conditions for the year 2020 within the Pajaro River Sub-basin are as follows:

South Santa Clara Valley 41,500 Acre-feet

Hollister Area 43,800 Acre-feet

Watsonville Area 19,900 Acre-feet

Moreover it is assumed that the San Felipe Project would deliver 30,900 acre-feet annually to the Gilroy-Hollister area. Delivery is projected to begin in the Watsonville area during the 1990's with an increase to the full project rate of approximately 105,200 acre-feet per year in 2020. Municipal and industrial requirements would be 52,900 acre-feet per year of full project delivery and 52,300 acre-feet would be provided for irrigation. The development and importation of good quality water may be the only feasible method to improve the San Benito County groundwater quality. It should be noted, however, that the above is highly conjectural at this time. Progress on all San Felipe projects is dependent upon support from DWR as well as Congress, and should the Bureau ignore DWR water quality objectives in the Delta, such support may not materialize.

Coastal Aqueduct

The planned Coastal Aqueduct of the California State Water Project would transport water from the California Aqueduct in the San Joaquin Valley to the coastal areas of San Luis Obispo and Santa Barbara Counties. Under contracts with the California Department of Water Resources, San Luis Obispo County is entitled to 25,000 acre-feet per year and Santa Barbara County is entitled to 57,700 acre-feet per year under conditions of full project delivery. Under currently projected requirements, full utilization of state project water would not occur in either San Luis Obispo or Santa Barbara Counties until after the year 2000.

Facilities of the California Aqueduct in the San Joaquin Valley, including about 15 miles of the Coastal Stub, have been completed. These facilities were sized to include the contractual entitlements of San Luis Obispo and Santa Barbara Counties. However, in order to deliver full contractual entitlements from the State Water Project, supplemental inflow to the Delta in addition to flows released from Oroville Reservoir storage will be required.

The existing Coastal Stub diverts water from the California Aqueduct at Avenal Gap, just north of the Kings-Kern County Line, about 12 miles south of Kettleman City. This water is lifted approximately 200 feet to elevation 500 feet by the existing Las Perillas and Badger Hill Pumping Plants and can flow an additional 11 miles by canal to the site of the proposed Devils Den Pumping Plant. Water is currently being delivered in the Coastal Stub to supply irrigation requirements to Devils Den and Berrenda Mesa Water Districts on the west side of the San Joaquin Valley.

In order to lift state project water over the Temblor Range into San Luis Obispo County, three pumping plants are planned which together would lift the water to an elevation of about 2,038 feet. Devils Den pumping plant would lift water about 410 feet to elevation 915 feet, Sawtooth Pumping Plant would lift water about 330 feet to elevation 1,243 feet and finally, Polonio Pumping Plant with an operating head of 810 feet would lift the water to elevation 2,038 feet.

The proposed Coastal Aqueduct beginning at Devils Den Pumping Plant would be a pressure pipeline designed to deliver the maximum coastal entitlements at a uniform flow rate during the year. Design flow in Devils Den, Sawtooth and Polonio Pumping Plants would be 126 cubic feet per second.

Polonio Pumping Plant would provide sufficient head so that water would flow southwest across the Upper Salinas Basin from the vicinity of Shandon, through Cuesta Pass and across Reservoir Canyon. From the top of the western divide of Reservoir Canyon, water would drop a vertical distance of about 700 feet to San Luis Obispo Power Plant. The Power Plant would have a design flow of 111 cfs and an installed capacity of 5.9 megawatts. Under conditions of full project delivery it would be capable of producing 42 million kilowatt hours of energy, or about 23 percent of the energy required at Devils Den, Sawtooth and Polonio Pumping Plants to lift the water over the Temblor Range. From the downstream end of San Luis Obispo Power Plant at about elevation 600 feet, water would flow by pipeline southeastward to the Santa Maria Terminus, at elevation 386 feet. Facilities of the State Water Project Coastal Aqueduct, as presently proposed, would terminate near the Santa Maria River, which is the northern boundary of Santa Barbara County. Capacity would be maintained in the aqueduct to deliver essentially all of the San Luis Obispo County entitlement to the San Luis Obispo Coastal Sub-basin and Santa Maria River Sub-basin downstream from San Luis Obispo Power Plant. According to the contract between San Luis Obispo County and the State, ultimate delivery would include 10,000 acre-feet per year at San Luis Obispo Power Plant, 5,000 acre-feet per year at Arroyo Grande Turnout, and 10,000 acre-feet per year at Santa Maria Terminus. Location of the Coastal Aqueduct in the southern Central Coastal Basin are shown on Figure 13-2.

The entire entitlement of 57,700 acre-feet would be delivered to Santa Barbara County at the Santa Maria Terminus. The major portion of the Santa Barbara County entitlement, about 46,700 acre-feet per year, would be required in the Santa Barbara Coastal Sub-basin. The facilities which Santa Barbara County proposes to construct to deliver state project water are shown on Figure 13-2 and are described below.

The proposed Santa Barbara County conveyance facilities would consist initially of a 38 mile pressure pipeline from the Santa Maria Terminus to Cachuma Reservoir, sized to carry the full Santa Barbara County entitlement at a uniform flow rate. Two pumping plants, with a combined operating head of 825 feet, would be required to lift the water out of the Santa Maria River Valley at elevation 360 feet and pump it to Cachuma

Reservoir, at elevation 750 feet. Tecolote Tunnel, with fairly minor revisions, could accomodate the combined Cachuma Reservoir yield and state project water deliveries.

Sometime around 1987, it is proposed to add Lompoc Lateral to the delivery system, with a capacity of 22 cfs to ultimately deliver 7,700 acre-feet per year to the city of Lompoc. Capacity would permit delivery of peak requirements at about twice the uniform flow rate. Lompoc Lateral would divert water from the Santa Maria-Cachuma conduit about eight miles downstream from the major pumping lift, and would require an additional pumping lift of 155 feet to connect with the proposed pipeline from Lompoc Reservoir, at elevation 620 feet. Lompoc Lateral would be approximately 13 miles long.

The State Water Project, including the Coastal Aqueduct was designed in the fifties, a period of postwar accelerated growth. Population projections, expanding acreage and intensifying degradation problems in this decade were interpreted as indicators of water shortages in much of the state. Water supply reports called for importation of water into Santa Barbara County between 1976 to 1978. Thus, Santa Barbara and San Luis Obispo Counties entered into contract with the Department of Water Resources to receive water from the project by 1980.

Since that time, the actual population growth has fallen behind those contemplated and projections for the future have been scaled down. Social objectives in the southern portion of the Central Coastal Basin have also changed. In the interest of conserving open space, air quality and other natural amenities of the area, there is a growing trend to discourage immigration. Those that support no-growth view the Coastal Aqueduct as a potential stimulator of population. Examples of controlling or limiting growth with facilities can be found throughout the basin. In two recent elections, three long-time members of the Goleta County Water District were unseated, predominately by a strict no-growth platform and two Santa Barbara County Supervisors favoring no-growth were elected in 1972. A similar limited growth atmosphere exists in San Luis Obispo County though perhaps not to the same degree.

Due to the less than projected rate of growth and the changing attitudes regarding water importation as discussed above, Santa Barbara County and the Department of Water Resources have entered into an agreement postponing construction of the Coastal Aqueduct until 1977 and initial deliveries until 1982. San Luis Obispo County, with fewer water problems, is expected to ask for a similar contract pushing these dates back an additional few years. Since both counties must act in unison, it is presently doubtful that water deliveries will be made before 1985. However, future evaluations of water needs may result in an extension or abridgment of the agreements.

Social objectives such as the one discussed above should be decided by the people within the area of influence. This plan is not designed to answer such questions nor should it be interpreted as an endorsement or rejection of these growth policies. The plan supports, on technical grounds, the importation of water to improve the quality and augment the existing supply, which is overdrafted or degraded in many areas. However, it is realized a technically feasible plan must be politically feasible and other alternative solutions are discussed. As alternatives are considered in this plan, local decision makers within the basin must first recognize that degradation and depletion of the water supply is occurring and all solutions, including importation, must be considered. An after the fact hook up ban may slow down the degradation and/or depletion of a groundwater basin but it is not a long term solution to water or growth problems.

Local Projects

In addition to the major state and Federal projects previously discussed, both agencies, along with other localized agencies, have investigated smaller localized projects. Since some sub-basins contain more than one localized project, the following discussion will be by sub-basin. The sub-basins that do not contain any planned localized projects will not be discussed.

Santa Cruz Coastal, San Lorenzo River and Aptos-Soquel Creeks Sub-Basins

Water supplies in the three small basins located around the northern portion of Monterey Bay will be developed to augment the municipal supply of the Santa Cruz area. These basins are well endowed with surface runoff.

As part of the master plan for the period through 2020, Santa Cruz County has proposed the construction of six reservoirs together with a program of diversions and backpumping to provide a total additional requirement in the Santa Cruz area on the order of 50,000 acre-feet per year by 2020. Suggested staging is for construction of Zayante Dam in 1975, Aptos in 1986, Scott Dam in 1989 and the Upper San Lorenzo, Glenwood and Upper Soquel Projects sometime after the year 2000. Runoff to the six reservoirs would provide a yield of approximately 28,400 acre-feet, and diversions and backpumping to the reservoirs would provide an additional yield of approximately 22,000 acre-feet. The proposed development would supply municipal requirements throughout the three sub-basins which would be mainly concentrated along the coast from Davenport to Aptos and along the narrow San Lorenzo River Valley. Alternative dam sites on Kings Creek and at Waterman's Switch on the San Lorenzo River will be considered for the Upper San Lorenzo Project. The proposed Glenwood, Upper Soquel and Aptos Reservoirs are located in the Aptos-Soquel Creeks Sub-basin. The master plan suggests that municipal water supply for the Soquel Highlands be provided from Lake Elsman in Santa Clara County.

In its 1965 Preliminary Edition of Bulletin No. 138, Coastal San Mateo County Investigation, the California Department of Water Resources has recommended water supply development for the San Mateo County Coastal area which would involve the northern part of the Santa Cruz Coastal Sub-basin. Their recommended stated development plan would divert the waters of Butano and Pescadero Creek to offstream storage in Bean Hollow Reservoir which is within the Santa Cruz Coastal Sub-basin. Bean Hollow would have an initial capacity of 25,000 acre-feet and would later be enlarged to a capacity of 72,500 acre-feet. Under full development, Bean Hollow with diversions, would provide a yield of about 19,600 acre-feet to serve the area north to Half Moon Bay. Project yield could be further increased by a 48,500 acre-foot reservoir on Gazos Creek within the Santa Cruz Coastal Sub-basin. The Department of Water Resources recommended initial construction of Bean Hollow Reservoir in 1970, but at the present time development of additional water supply for the San Mateo Coastal area is being held in abeyance.

Salinas River Sub-Basin.

Nacimiento Reservoir, with a gross storage capacity of 350,000 acre-feet, was completed in 1957. Although the reservoir which controls the waters of the Nacimiento River is within San Luis Obispo County, all but 17,500 acre-feet of the estimated annual yield of 85,000 acre-feet is committed to use in Monterey County. San Luis Obispo County has not yet constructed diversion facilities to utilize Nacimiento water, so that currently, almost the entire yield is available for groundwater discharge in Monterey County.

The San Luis Obispo County Master Plan recommends the construction of a pumping plant at Nacimiento Reservoir and a pipeline which would convey 15,000 acre-feet south, most of it across the coastal divide into the Old Creek drainage where it would be stored in Whale Rock Reservoir and used in the coastal area. However, as part of this project, it is recommended that approximately 1700 acre-feet per year be released into Jack Creek for use in the Upper Salinas basin. This release would flow down Jack Creek and Paso Robles Creek to the Salinas River and would recharge the groundwater basin underlying the Salinas River from Templeton north. The communities of Templeton, Paso Robles and San Miguel withdraw groundwater along this reach of the Salinas River.

In the lower Salinas River basin there are several potential projects which would provide additional water for groundwater recharge or would convey water to areas of heavy groundwater draft. The California Department of Water Resources has estimated that an annual yield of up to 78,000 acre-feet could be developed by a reservoir on the Arroyo Seco tributary to the Salinas River near Soledad, depending on the capacity of the reservoir and method of operation of the reservoir and downstream groundwater basins. Planning has not reached the stage where capacities or yields for a potential project have been determined. Yield from a reservoir on the Arroyo Seco could be used for surface irrigation or groundwater recharge in the Arroyo Seco cone area and/or it could supply downstream direct deliveries in areas of high groundwater pumpage.

Two reservoirs have been proposed to provide a local surface water supply in the upper Salinas basin. The proposed Jack Creek Reservoir with a storage capacity of 29,000 acre-feet would provide an annual yield of about 7100 acre-feet. A reservoir on Jack Creek could also regulate to a seasonal demand pattern the releases from the proposed Nacimiento-Whale Rock conduit. The proposed 22,000 acre-feet capacity Santa Rita Reservoir on Santa Rita Creek would have an estimated yield of 6500 acre-feet. Jack Creek and Santa Rita Reservoirs could provide a municipal supply to the Atascadero-Templeton-Paso Robles area. Water from Santa Rita Reservoir could also be pumped over the coastal divide into Old Creek where it would be stored in Whale Rock Reservoir to meet coastal area demands.

If the Nacimiento-Whale Rock conduit and/or the Coastal Branch of the State Water Project are constructed, it is unlikely that Jack Creek and Santa Rita Reservoirs would be required during the study period prior to the year 2000.

Several projects have been proposed to ameliorate conditions in the East Side and Pressure aquifers of the Salinas Valley. The East Side Project would divert water from the Salinas River near Soledad and convey it by canal down the east side of the Salinas Valley. This water would be supplied to the East Side area for surface irrigation and for groundwater replenishment to supplement natural recharge to the area. Another proposed project would divert water from the Salinas River near Salinas and convey it to the Castroville area for surface irrigation.

San Luis Obispo Coastal Sub-Basin

In the 1950's, the California Department of Water Resources investigated a number of reservoir sites in the north coastal area of San Luis Obispo County. Reservoirs were sized to supply future water requirements primarily in the central coastal area in the vicinity of the city of San Luis Obispo. Proposed reservoirs in the north coast area include Bald Top and Ragged Point Reservoirs on San Carpoforo Creek, Yellow Hill Reservoir on Arroyo de la Cruz, San Simeon Reservoir on San Simeon Creek and Santa Rosa Reservoir on Santa Rosa Creek. Storage capacities for the largest size reservoirs studied by the California Department of Water Resources, together with the latest estimated annual yields, are shown in Table 13-2. In the San Luis Obispo County Master Plan for Water Development, the north coast reservoirs are considered as alternatives to delivery of State Project water and delivery of Nacimiento water to Whale Rock Reservoir. Since the master plan recommends these latter projects, it is unlikely that any of the north coastal reservoirs will be constructed during the study period.

Supplemental water supplies in the potential service area of the Nacimiento-Whale Rock Pipeline will be required as early as 1975. Supplemental water supplies in the potential service area of the Coastal Aqueduct will be required beginning in 1980.

The San Luis Obispo County Master Plan for Water Development recommends the construction of a pipeline from Nacimiento Reservoir by 1975 with a capacity sufficient to deliver about 13,300 acre-feet per year to the Central Coastal area. Nacimiento water would be delivered to Whale Rock Reservoir for reregulation to a seasonal demand pattern.

Santa Maria River Sub-Basin

The United States Bureau of Reclamation is currently investigating on a reconnaissance basis the feasibility of constructing a reservoir on the lower reaches of the Sisquoc River. It is estimated that a dam at the Round Corral site might conserve as much as 6,000 acre-feet per year. If Round Corral Dam were constructed, it would be operated in conjunction with Twitchell Reservoir to provide water for groundwater recharge in the Santa Maria Valley.

Santa Ynez River Sub-Basin

The United States Bureau of Reclamation has been investigating the feasibility of a multipurpose dam and reservoir on the lower Santa Ynez River just upstream from the City of Lompoc. It is estimated that Lompoc Reservoir, with a gross storage capacity of 425,000 acre-feet could provide an additional yield in the Santa Ynez basin on the order of 16,600 acre-feet per year. The proposed Lompoc Project would provide a surface supply to Vandenberg Air Force Base and the communities of Lompoc, Vandenberg Village, and Mission Hills. Releases would also be made from Lompoc Reservoir downstream for groundwater recharge.

Santa Barbara Coastal Sub-Basin

The engineer for the Santa Barbara County Water Agency has recommended construction of the Coastal Aqueduct of the California State Water Project by about 1980 as the most feasible means of obtaining a supplemental water supply. He states that equivalent unit cost of state water delivered to the Santa Barbara Coastal Sub-basin at the southern portal of Tecolote Tunnel would be about $205 per acre-foot.[12]

Under conditions of full project delivery for the Coastal Aqueduct, the major portion (approximately 47,000 out of a total delivery of approximately 83,000 acre-feet or about 57 percent of the project water supply) is scheduled for delivery in the Santa Barbara Coastal Sub-basin.

There are additional alternatives for an interim supply to the Santa Barbara Coastal Sub-basin that should be given serious consideration. Draft of Cachuma Reservoir storage in excess of safe yield may be possible. Coordination of water use with Ventura County which has an entitlement of 20,000 acre-feet per year from the West Branch of the California Aqueduct and which has a water supply in Lake Casitas in excess of requirements through at least the year 1980 may prove mutually beneficial to both countries.

The United States Bureau of Reclamation has forecast that as a result of urbanization of irrigable land, irrigation requirements will be negligible shortly after the year 2000 in the sub-basin.[13]. Removing these lands from production in 1980 would reduce the requirement for supplemental water in the Santa Barbara Coastal Sub-basin until about 1990.

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8. California State Water Resources Control Board, Interim Water Control Plan for the Central Coastal Basin, June, 1971.

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10. Roger Lindholm, California Department of Water Resources, Desalinization Division, Personal Communication, September 1973.

11. Martin Whidding, U.S. Bureau of Reclamation, Planning Division, Personal Communication, January 1974.

12. Bookman and Emonston, Report on Program for Importation of State Project Water to Santa Barbara County, May 1970.

13. U.S. Bureau of Reclamation, Water Requirements for the Central California Coastal Area.

Chapter 14 Water Quality and Quantity Problems

The comprehensive water quality control plan for the Central Coastal Basin must assess existing water quality, and identify present and potential water quality and quantity problems. This is necessary not only to insure that sufficient water of adequate quality is available for man's use directly, but also to insure that his use (or misuse) of water will not degrade its quality to the extent that the other beneficial uses of water are threatened. In the following sections the existing quality of the surface and groundwaters of the basin is described. Present and potential water quality and quantity problems are discussed.

EXISTING WATER QUALITY

Existing surface and groundwater quality conditions are discussed in this chapter by sub-basin and significant contributors to water quality degradation are identified.

Surface Water Quality

Stream flows in the Central Coastal Basin vary greatly due to the highly seasonal rainfall, as discussed in Chapter 11. The soils of those areas which are basically arid contain large concentrations of soluable ions which have not been washed out by excessive leaching. Consequently the average levels of chemical constituents in the runoff waters are comparatively high and are also variable with higher concentration occurring during periods of low flow.

Santa Cruz Coastal Sub-Basin

Little data on surface water quality are available. However, water quality is apparently suitable for all present beneficial uses.

San Lorenzo River Sub-Basin

The present mineral quality of surface waters in the San Lorenzo Sub-basin is primarily the result of the type of geologic formations through which the water flows. Data collected by the California Department of Water Resources and the U.S. Geological Survey are reported in Table 14-1. These data show that the general mineral quality of surface waters within the basin is excellent for all uses. Water from west side streams is somewhat softer than east side surface waters. Limited data on turbidity and suspended solids indicate that west side tributaries are generally clearer than east side streams.

Aptos-Soquel Creeks Sub-Basin

Quality of surface waters in the Aptos-Soquel Creeks Sub-basin is generally good and waters are suitable for all uses. Coastal water quality problems are described elsewhere in this chapter.

Pajaro River Sub-Basin

Most of the streams in the Pajaro River Sub-basin are intermittent and flow from late fall through early summer. Table 14-2 gives values which are typical of present conditions, although wide variations occur in practically all of the streams. Surface water quality in South Santa Clara Valley is generally satisfactory for all beneficial uses. However, quality in Llagas Creek near the mouth is unsatisfactory for irrigation at low flow conditions.

Quality of surface flows in the Pajaro River steadily deteriorates from the headwaters in San Felipe Lake throughout its length to the ocean. San Felipe Lake is supplied primarily by Pacheco Creek. Most of the water quality degradation in the Pajaro River Basin results from mineralization by irrigation return flows; however bacterial contamination has occurred in adjacent coastal waters. See later discussion on Monterey Bay quality problems.

Salinas River Sub-Basin

Quality of surface waters in the Salinas River Sub-basin varies widely with location and time of occurrence. In general, surface waters draining from the Diablo Mountains are high in mineral concentration. Surface waters of Pancho Rico Creek and San Lorenzo Creek exceed 100 mg/l TDS. Waters from the Santa Lucia Mountains are of good quality with moderate concentrations of minerals. The lower Salinas River, from Chualar to the mouth, is higher in mineral concentration than the river above Chualar but lower than waters from the Diablo Mountains. Problems associated with poor water quality in the lower Salinas River below Spreckles Range are described later in this chapter and in Chapter 15. Coastal water quality problems are also described in this chapter.

Some representative values of quality of surface waters within the sub-basin are reported in Table 14-3. Isolated areas of water quality impairment exist in the basin that are not reported by the data in the table. However, these cases are not

Table 14-1. Mean Surface Water Quality in San Lorenzo River Basin

Quality[a]	San Lorenzo Creek	Boulder Creek	Newell Creek	Zayante Creek	Lompico Creek	Branciforte Creek
Specific conductance (micromhos)	382	207	560	658	506	641
TDS	232	135	-	430	325	-
Hardness	139	79	233	260	216	245
Phosphate	0.47	0.16	0.17	0.40	0.49	0.78
pH (units)	7.7	7.6	7.4	8.1	8.1	8.0
Sodium	25	11	23	36	27	33
Chloride	26	9.6	20	30	20	35
Nitrate	0.75	0.7	1.0	0.6	0.9	1.9
Turbidity (units)	5.0	2.5	3.3	2.2	1.6	3.5
Dissolved oxygen	10.5	10.3	9.9	10.2	10.5	10.9

[a] Reported in milligrams per liter unles otherwise noted.

Table 14-2. Surface Water Quality in Pajaro River Basin

Quality[a]	Pajaro River at Chittenden	San Benito River near Bear Valley	Llagas Creek at Llagas Road	Uvas Creek near Morgan Hill	Carnadero Creek at Bloomfield Road	Corralitos Creek at Corralitos	Browns Creek near Corralitos
Specific conductance (micromhos)	1,700	2,160	265	230	410	580	730
TDS	1,100	1,400	152	140	253	470	600
Hardness	450	645	118	110	180	240	260
Boron	1.2	1.8	0.07	0.04	0.17	0.04	-
pH (units)	8.2	8.4	8.1	7.7	8.3	8.3	7.9
Sodium	225	260	8.0	7.1	15	23	50
Chloride	260	192	5.4	5.5	8.4	20	37
Nitrate	2.2	0.3	0.7	0.8	1.6	0	0.2
Sulfate	210	356	18	22	32	35	43
Dissolved oxygen	9.7	10.0	-	10.8	-	-	-

[a] Reported in milligrams per liter unless otherwise noted.

widespread and usually are caused by inordinately high concentrations of some specific constituent such as boron, nitrate or chloride. Such high values are a result of natural mineralization in most instances, although agricultural drainage is a contributory factor.

Carmel River Sub-Basin

The quality of water in the Carmel River is excellent, being characterized as calcium-magnesium bicarbonate with total dissolved solids concentrations from 100 to 200 mg/l. The ephemeral streams that recharge the basin are also of excellent quality except for Tularcitos and Chupines Creeks which contribute waters that are naturally high in sulfates and total dissolved solids concentrations; TDS ranges from 100 to 1400 mg/l.

Monterey Coastal Sub-Basin

Streams discharging directly to the ocean between Point Carmel and the San Luis Obispo County Line are divided into the four following groups: Point Carmel to Little Sur drainage, Point Sur area, Cooper Point to Lopez Point, and Lopez Point to the San Luis Obispo County line.

Streams in the Point Carmel to Little Sur drainage change from sodium-chloride on the north and in Gibson Creek to calcium-bicarbonate on the south in Bixley Creek. The concentration of dissolved minerals tends to decrease from north to south. In these streams, total dissolved solids ranged from approximately 120 to 280 mg/l with a median concentration of about 185 mg/l.

Most of the surface water in the Point Sur area reaches the ocean through the Little Sur and Big Sur Rivers. Water draining from this area is usually calcium-bicarbonate with total dissolved solids of about 170 mg/l. The Big Sur River passes through the most popular and heavily used recreation areas in the coast. There are no evident adverse effects from development on the mineral quality of the water.

Streams draining the area from Cooper Point to Lopez Point are calcium-bicarbonate with a median total dissolved solids concentration of about 200 mg/l. Streams draining the area between Lopez Point and the San Luis Obispo County line change gradually from calcium-bicarbonate in Limekiln Creek on the north to magnesium-calcium bicarbonate in Salmon Creek on the south. This group of streams has a median total dissolved solids concentration of approximately 210 mg/l.

San Luis Obispo Coastal Sub-Basin

Surface waters in the San Luis Obispo Coastal Sub-basin are generally of better quality than in the rest of the Central Coastal Region. The relatively high nitrate concentrations in San Luis Obispo Creek may be attributed to the discharge of San Luis Obispo's municipal wastewater to the creek and to agricultural runoff in the watershed area. A small impoundment on Spanish land grant property downstream from the San Luis Obispo discharge has eutrophication problems. White Lake and Pismo Lagoon are stagnant, coastal lakes which accumulate salts by evaporation and by inflow of seawater due to tidal action, thus accounting for their poor quality; neither lake is used for water supplies. The waters of Whale Rock and Lopez Reservoirs are used for domestic water supplies for San Luis Obispo and Arroyo Grande areas, respectively. Their waters are of quite acceptable quality for all constituents save hardness, which, at approximately 260 mg/l as $CaCo_3$, is comparatively high. Water quality data are summarized in Table 14-4.

Soda Lake Sub-Basin

Surface water flow occurs only during storms and then quickly percolates into the groundwater basin. There is no surface water outflow from the basin so all the salts accumulate in Soda Lake. Limited data for Soda Lake itself show that it is a typical desert dry lake. See Table 14-4.

Santa Maria River Sub-Basin

The arid climate of the Cuyama Valley is the prime reason for the relatively poor quality of the Cuyama River. Twitchell Dam was built to provide water for groundwater recharge downstream in the Santa Maria Valley. The Cuyama River water tends to be of poorer quality than rainwaters and the waters of the Sisquoc River which infiltrate directly into the soils of the Santa Maria Valley. Data are provided in Table 14-4.

San Antonio Creek Sub-Basin

Limited water quality data are available for surface waters in the San Antonio Creek Sub-basin; it is known that the flows are highly variable and seasonal. Surface waters would therefore be expected to be more highly mineralized during periods of low flow.

Table 14-3. Surface Water Quality in the Salinas River Basin

Stream segment	Quality[a]									
	Specific conductance (micromhos)	TDS	Hardness	Calcium	Magnesium	Sodium	Chloride	Nitrate	Sulfate	Boron
Gabilan tributaries										
Gabilan Creek	417	295	160	42	13	27	35	4	36	0.13
Quail Creek	355	220	106	26	10	28	38	5	24	0.05
Diablo tributaries										
Pancho Rico Creek	1,780	1,370	770	204	64	134	14	-	820	0.39
San Lorenzo Creek	1,770	1,170	475	84	65	207	135	-	560	0.84
Santa Lucia tributaries										
Nacimiento River	270	160	120	39	6	9	6	1.0	29	0
San Antonio River	365	230	144	35	14	20	13	1.0	59	0
Arroyo Seco River	250	170	105	30	7	10	6	1.0	37	0
Salinas River										
Near Santa Margarita	540	360	230	44	28	37	27	2.4	114	0.09
At Paso Robles	650	430	296	75	30	37	33	2.0	112	0.14
Near Bradley	367	216	151	34	18	16	13	1.0	99	0.10
Below Chualar	810	690	370	37	13	130	147	2.8	56	0.40
Near Spreckels	890	600	304	77	32	74	80	13.0	64	0.20
At Lagoon	2,400	1,400	460	41	74	312	372	3.1	304	0.70

[a] Reported in milligrams per liter unless otherwise noted.

Table 14-4. Surface Water Quality in the Southern Portion of the Central Coastal Basin[a]

Sub-basin/water source	Number of analyses	Chloride, mg/l High	Chloride, mg/l Avg.	Chloride, mg/l Low	Nitrate, mg/l High	Nitrate, mg/l Avg.	Nitrate, mg/l Low	Boron, mg/l High	Boron, mg/l Avg.	Boron, mg/l Low	TDS, mg/l High	TDS, mg/l Avg.	TDS, mg/l Low	Total hardness, as $CaCO_3$, mg/l High	Total hardness, as $CaCO_3$, mg/l Avg.	Total hardness, as $CaCO_3$, mg/l Low	Percent Sodium[l]
San Luis Obispo Coastal[b]																	
Santa Rosa Creek	14	52	25	7	4.5	2.0	0	0.20	0.15	0.08	636	458	180	461	321	107	15
Cayucos Creek	5	162	54	12	9.0	5.0	1.2	0.37	0.21	0.10	948	401	150	456	245	84	27
Old Creek	14	46	24	7	5.8	2.7	0	0.40	0.13	0	876	436	190	399	284	114	17
Morro Creek	11	152	33	7	15.5	4.6	0	0.30	0.12	0	1164	348	165	657	238	89	30
Chorro Creek	12	77	43	19	9.9	4.1	0	0.20	0.09	0	704	433	234	512	333	166	15
Los Osos Creek	3	35	21	8	2.5	2.2	2.0	0.35	0.18	0.04	395	236	130	277	174	85	17
San Luis Obispo Creek	13	160	94	24	40.2	14.2	0	0.65	0.19	0	986	622	180	640	412	101	22
Pismo Creek	36	136	65	13	17.7	5.7	0	1.10	0.28	0.05	915	740	162	645	520	116	22
Arroyo Grande Creek	17	53	32	13	14.0	3.0	0	0.12	0.06	0	825	605	265	587	428	152	17
Lopez Creek	4	18	13	10	1.0	0.3	0	0.19	0.06	0	518	390	190	413	297	122	7
Laguna Lake	1	-	82	-	-	4.3	-	-	0.20	-	-	422	-	-	295	-	26
White Lake	3	676	481	279	37.2	25.8	2.5	1.40	1.00	0.60	2400	2178	1913	922	768	511	56
Pismo Lagoon	3	3464	1375	210	6.8	4.3	0	1.30	0.50	0	7626	3417	1036	1682	969	547	65
Whale Rock Reservoir[c]	1	-	33	-	-	0.15	-	-	0.4	-	-	350[m]	-	-	252	-	20
Lopez Reservoir[d]	1	-	14	-	-	1.5	-	-	0.06	-	-	325	-	-	268	-	12
Sub-basin Total[j]	129	162	40	7	40.2	3.6	0	1.10	0.17	0	1164	443	130	657	313	84	18
Soda Lake																	
Soda Lake[e]		-	60,600	-				-	42	-	-	221,000	-				
Santa Maria River																	
Cuyama River																	
below Twitchell Reservoir[f]	2	83	54	25	1.5	1.2	0.8	0.31	0.25	0.19	1530	1051	572				24
San Antonio Creek																	
No data																	
Santa Ynez River																	
Santa Ynez River																	
at Cachuma Reservoir[g]	-	20		11	2.3		0	0.45		0	620		501	379		160	
Cachuma Reservoir[h]	1	-	15	-	-	0.4	-	-		-	-	545	-	-	328	-	23
Santa Ynez River																	
near Solvang[g]	-	84		17	7.1	-	0	0.72		0	874		565	667		162	
Gibralter Reservoir[h]	3	23	18	10	2.9	1.1	0.15				1025	867	560	605	513	345	19
Sub-basin Total[k]	4		17			0.8						706			421		21
Santa Barbara Coastal[i]																	
Canada de la Gaviota	3	387	161	21	7.1	2.7	0	1.4	0.67	0.20	1630	880	440	740	435	252	36
Tajiguas Creek	2	231	205	179	0	0	0	0.69	0.62	0.54	2110	2000	890	1200	1092	984	29
Canada del Refugio	1	-	30	-	-	0	-	-	0.20	-	-	514	-	-	310	-	31
Canada del Corral	5	232	65	13	5.0	2.6	0	0.7	0.21	0	2250	773	250	1200	497	151	25
Ellwood Canyon	1	-	34	-	-	0	-	-	0.08	-	-	1190	-	-	686	-	15
Sub-basin Total	12	387	99	13	7.1	1.1	0	1.4	0.36	0	2250	1072	250	1200	604	151	27

[a]Sources:
[b]Water Quality Conditions Coastal Region, San Luis Obispo County, Central Coastal Regional Water Quality Control Board, 1969 (data 1950 - 1968).
[c]Water Analysis Report, Cook Research Laboratories, Inc., Dec., 1972.
[d]Water Analysis Report, Thorpe Laboratories, February, 1970.
[e]California Regional Water Quality Control Board, Central Coastal Region. Interim Water Quality Control Plan for Central Coastal Basin. June, 1971 (analysis done September, 1954)
[f]Water Resources Data for California, Part 2. Water Quality Records, United States Department of the Interior, Geological Survey, 1969.
[g]Water Quality Control Policy for Santa Ynez River Basin and Underlying Ground Waters, Central Coastal Regional Water Quality Control Board, 1969.
[h]Water Analysis Report, California Department of Public Health, Sanitation and Radiation Laboratory, 1970.
[i]Chemical analyses made by California Department of Water Resources, 1958-62.
[j]Excluding White Lake and Pismo Lagoon.
[k]Averages for Cachuma and Gibralter Reservoirs only.
[l]Percent sodium computed from averages for sodium, calcium, and magnesium.
[m]Electrical Conductivity = 568 micromhos, approximately 350 mg/l TDS.

Santa Ynez River Sub-Basin

Surface water data for the Santa Ynez River Sub-basin are limited; TDS and hardness are moderately high but are generally acceptable for most uses. Gibraltar and Cachuma Reservoirs provide water for the Santa Barbara coastal urban area. Water in Cachuma Reservoir is of acceptable quality but its hardness (328 mg/l as $CaCO_3$) is relatively high. The waters of Gibraltar reservoir are of poorer quality with a moderately high average TDS of 867 mg/l and a hardness of 513 mg/l as $CaCO_3$, which is very high. Other data are contained in Table 14-4.

Santa Barbara Coastal Sub-Basin

Streams in the Santa Barbara Coastal Sub-basin drain the south slope of the Santa Ynez Mountains and are seasonal in flow. Water quality is poor, especially in terms of TDS and hardness but relatively little surface water is used directly for water supplies in this sub-basin. However, the flows do provide a source for recharging the groundwater basins in the area. Data are summarized in Table 14-4.

Ground Water Quality

Wide variations in quality within a groundwater basin occur due to factors such as penetration of separate aquifers at different individual well depths, poor well construction and dissimilar local geologic conditions. Accordingly calculated average values give only a general indication of water quality in a given sub-basin. Variations often occur between the area of recharge and downstream pumping zones.

Concentrations of various chemical constituents in groundwaters are determined by the environments through which the water passes. The quality of water recharging an aquifer, be it rainwater, surface water, or a wastewater effluent will be altered by reactions with the minerals encountered in water bearing formations through which percolation occurs. Even before the influence of man's activities became significant, groundwater in some areas was of generally poor quality due to pick up of mineral constituents from the predominantly sedimentary rocks of the basin.

Tables 14-5 to 14-8 summarize data collected by the California Department of Water Resources and the U.S. Geological Survey on groundwater quality in the Central Coastal Basin.

Santa Cruz Coastal Sub-Basin

No significant groundwater reserves are reported for this area.

San Lorenzo River Sub-Basin

Table 14-5 shows representative groundwater quality data and indicates, generally, that the waters are satisfactory for domestic, industrial and agricultural water supplies. Spring water near Newell Creek was the poorest quality groundwater sampled but is still satisfactory for domestic use.

Aptos-Soquel Creeks Sub-Basin

Limited data on groundwater quality indicate that groundwaters used for domestic water supply are of acceptable quality.

Pajaro River Sub-Basin

Extreme variations exist in the quality of groundwaters throughout the basin. The values presented in Table 14-6 are typical of the groundwater quality conditions in the areas represented. Values can differ greatly even in adjacent wells and will vary according to well depth, influence of agricultural practices, waste discharges and local geology.

In the Hollister and Tres Pinos area groundwater mineral quality is Class 2 and Class 3 for irrigation due to high boron and TDS concentrations. Water from the principal aquifers is usually acceptable for irrigation use even though total dissolved solids concentrations are frequently high. Many of the groundwater quality problems near Hollister result from the complex geology of the area.

In the upper Pajaro River Sub-basin groundwater quality is generally very good for all uses. Waters are about one-half as mineralized as groundwater in the Hollister and Tres Pinos area. Groundwater in the Santa Clara Valley is generally of excellent mineral quality and suitable for most beneficial uses.

Water quality throughout the deeper confined aquifers of the Pajaro Valley is good to excellent and the water is acceptable for all beneficial uses. The one area of mineral degradation is along Monterey Bay where seawater intrusion has occurred in the lower confined zone. High groundwater extraction rates could also be drawing connate waters upward from deeper marine

Table 14-5. Groundwater Quality in the San Lorenzo River Basin

Characteristic[a]	Bear Creek Spring	Industrial Wells	Irrigation Well	Newell Creek Spring	Boulder Creek Spring
Specific conductance (micromhos)	690	81	621	1,120	432
TDS	429	73	400	-	242
Hardness	229	21	246	525	171
Boron	0.1	0.05	0.0	-	0.0
pH (units)	7.6	6.9	7.3	6.8	8.0
Sodium	47	7.7	31	-	19
Chloride	47	5.3	20	54	23
Nitrate	0.5	1.9	2.5	1.0	9.8
Sulfate	130	2.8	167	-	34

[a] Reported in milligrams per liter unless otherwise noted.

Table 14-6. Groundwater Quality in the Pajaro River Basin

Characteristic[a]	Hollister	Tres Pinos	San Felipe	Morgan Hill	San Martin	Gilroy	Watsonville
Specific conductance (micromhos)	1,900	1,480	970	350	340	490	550
TDS	1,210	940	580	205	252	296	450
Hardness	740	510	240	126	205	220	220
Boron	1.0	1.6	0.3	0.06	0.13	0.14	0.15
pH (units)	8.3	7.9	8.2	7.6	7.4	8.0	7.3
Sodium	170	140	120	16	13	17	27
Chloride	116	125	80	28	18	14	30
Nitrate	7.6	4.2	0.6	28	1.5	13	6
Sulfate	262	240	70	5	18	40	28

[a] Reported in milligrams per liter unless otherwise noted.

Table 14-7. Groundwater Quality in the Salinas River Basin

Characteristic, mg/l	Upper Valley area	Lower Forebay area	Upper Forebay area	Pressure area[a]	Pressure area[b]
Specific conductance, micromhos	935	2,990	1,200	2,000	618
TDS	582	2,030	790	1,414	400
Magnesium	39	129	50	70	23
Boron	0.3	0.40	-	0.6	0.19
Calcium	70	332	77	107	59
Sodium	58	154	100	255	41
Chloride	122	319	84	243	27
Nitrate	14.0	33	6.9	0	0
Sulfate	113	840	281	624	102

[a] 180-foot aquifer

[b] 400-foot aquifer

sediments believed to exist below the pumped aquifers[1, 2, 3]. There is insufficient knowledge of the Pajaro Valley hydrogeology to specify the exact source of these coastal groundwater quality problems. Groundwaters overlying the confined zone are inferior in quality and probably derive higher mineral concentrations from agricultural and unsewered domestic returns and some ocean waters.

Salinas River Sub-Basin

Groundwater in the Salinas Valley is a mixture of natural surface waters that percolate from streams, water released from storage projects, agricultural, municipal and industrial wastewaters and sea water. Groundwater quality characteristics of representative wells are shown in Table 14-7. These data show great variability in groundwater quality from one area to another.

Major sources of recharge to the groundwater basin, the Salinas River and Arroyo Seco, are generally of very good quality with average historic TDS values of 210 mg/l and 170 mg/l, respectively. However the quality of Salinas River water does vary. Recorded groundwater TDS values range from 300 mg/l to 2400 mg/l.

The four basic sources of groundwater contamination in the Salinas Valley are described below. Two are apparently from natural sources and the other two are apparently man-induced.

By referring to Figure 14-1 it can be seen that there is an area of very high TDS along the eastern side of the Salinas Valley extending from San Ardo to Greenfield. This area of poor water quality is caused by surface water in San Lorenzo Creek and other East Side streams draining the Diablo Range. These streams have very poor water quality with TDS values frequently exceeding 3000 mg/l.

The second groundwater quality problem is located in the valley floor at Gonzales where a salinity mound has been located for a number of years. The hydrogeology of the basin in this area and the configuration of the salinity mound indicate there has been an exceptionally high amount of total dissolved solids returning to groundwater from some unknown source. The only known major discharges which exist in this area are feedlots; however the salt mound existed prior to the feedlots.

The third area of poor water quality exists around Salinas. The salt mound is located mainly in the 180-foot aquifer and indicates a possibility of hydraulic connection between the surface and the 180-foot aquifer. The salt mound appears to have increased in area but not concentration during the last ten years. Presently accepted interpretations of basin geology and hydrogeology leave the most probable source of this poor quality water as percolating return waters from surface land use. As a highly developed urban and agricultural area, no one land use or discharger has been identified as potentially causing the problem.

Another potential source of groundwater contamination in this area is connate water from marine sediments which could be causing the high TDS and chloride concentrations. Present knowledge of regional geology[1, 2, 3] detailed inspection of the shape of the salinity mound in the East Side, 180-foot and 400-foot aquifers and considerations of the chemical composition of the contaminated waters[4] all lend credence to the possibility of connate waters moving upward and into the basin from one or both sides of the valley.

The fourth groundwater quality problem in the basin is located along the coast. Both the 180-foot and the 400-foot aquifer waters have high TDS and chloride contents with recorded values highest at the coast. This contamination has traditionally been identified with sea water intrusion from Monterey Bay. During the summer excessive groundwater extractions have lowered well levels creating landward hydraulic gradients which suggest the possibility of sea water intrusion. Other potential sources of contamination exist; a pumpage trough could serve to collect poor quality agricultural return waters. Observations by the Department of Water Resources and the presence of two isolated salt mounds in this area support this possibility. See Fig. 14-1. Percolation of agricultural return flows into the 180-foot aquifer is possible as "holes" exist in the confining layer above; the overlying aquiclude is lenticular and not regionally continuous. Percolation of overlying waters through the aquiclude would be expected to retard sea water intrusion.

Recent geologic investigations show the existence of marine sediments below the pumped aquifers and regional hydraulic gradients in the deeper aquifers around Monterey Bay.[1, 2, 3] These observations open up the possibility of movement of connate waters into this area of exceptionally high pumpage rates.

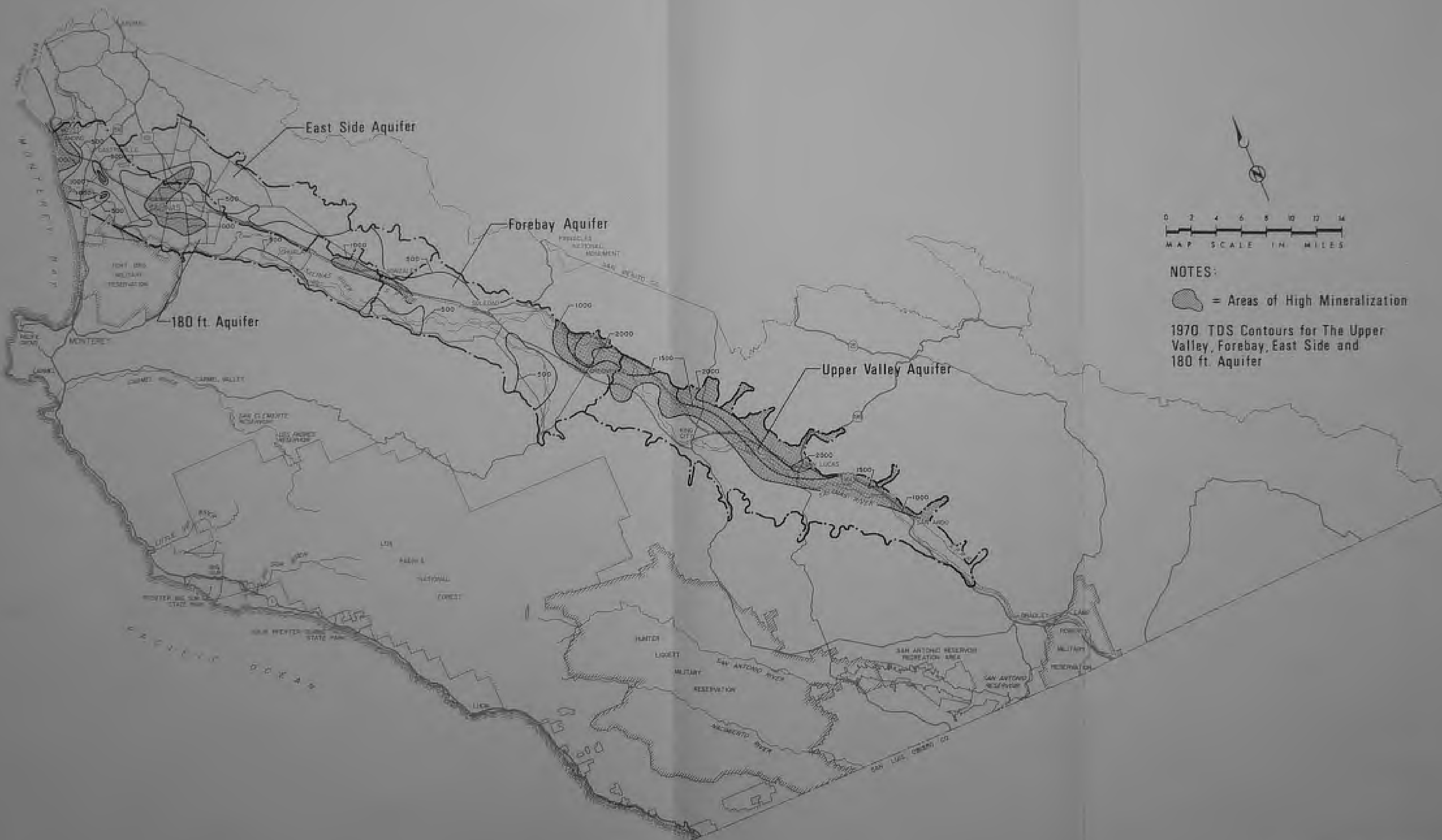

Fig. 14-1A Existing Groundwater Quality in the AMBAG Area

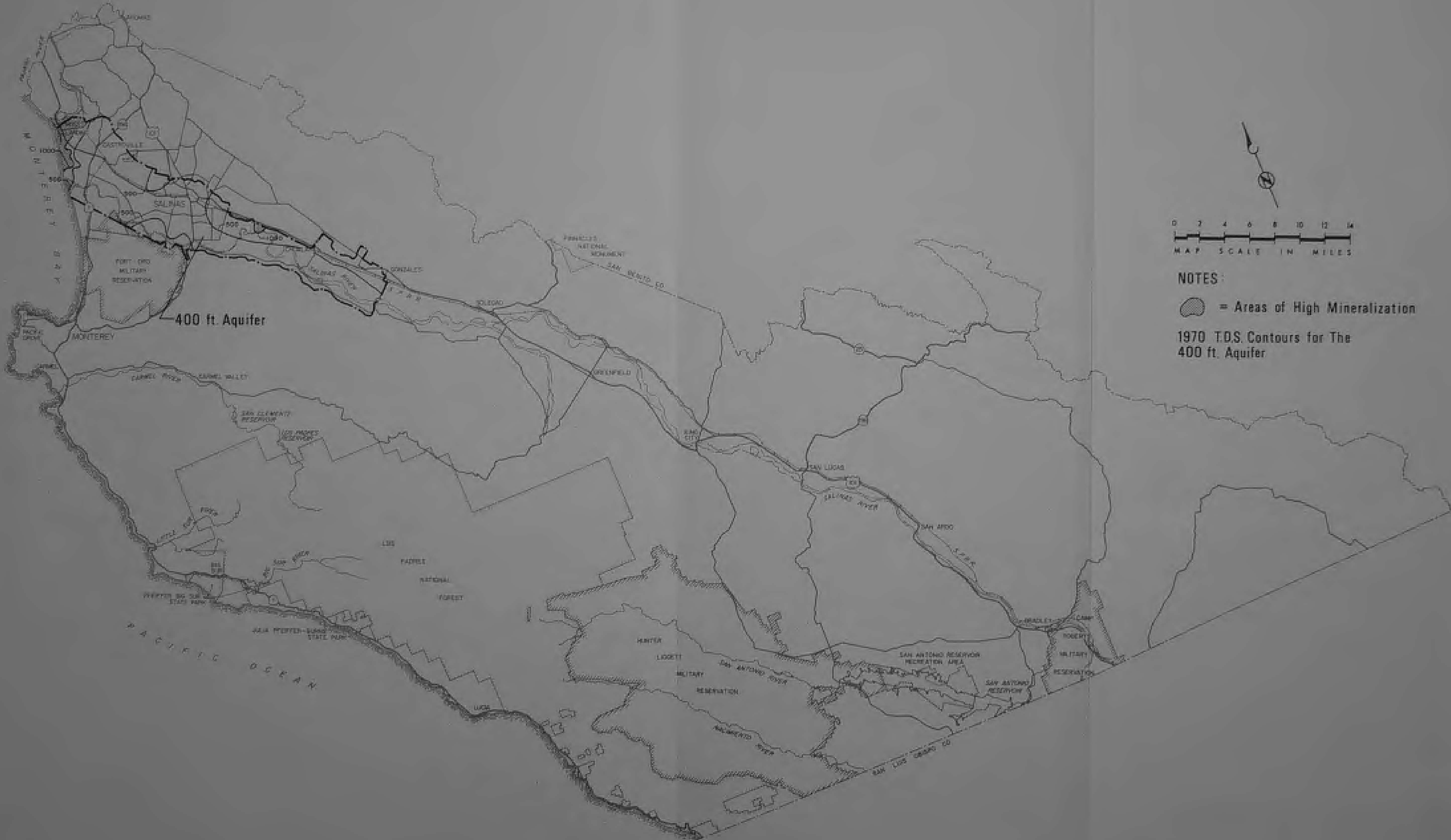

Fig. 14-1B Existing Groundwater Quality in the AMBAG Area

All of these observations give much weight to the possibility that the high TDS and chloride concentrations along the coast could be caused by phenomena other than sea water intrusion. These other potential sources of pollution must be carefully considered in future groundwater basin management.

In July 1973 a report entitled "Sea Water Intrusion, Lower Salinas Valley" was issued by the Department of Water Resources.[5] The DWR report conclusions suggest that sea water intrusion is continuing in both the 180 and 400 foot aquifers and that over 50 square miles of agricultural land overlying the area intruded by sea water could be forced out of production by the year 2020 if present trends of groundwater development and use continue. The DWR report recommends that groundwater pumping be controlled to eliminate or reduce the present overdraft and that supplemental water be brought into the area to reduce demand on groundwater. Further recharge activities, monitoring and controls were also suggested. Methods for control of sea water intrusion listed in the report include 1) controlled pumping, 2) supplemental water supply, 3) intrusion barrier, 4) water supply change and 5) adoption and enforcement of water well standards. Regulatory controls, such as adjudication of affected groundwater basins, are available to effect correction of degradation caused by overpumping.

Carmel River Sub-Basin

Groundwater in the basin is generally of excellent quality. The character and quality do not vary significantly throughout the basin. Groundwater is generally of the calcium-sodium bicarbonate type, with total dissolved solids concentrations ranging from 400 mg/l in the upper end of the basin to 700 mg/l near the coast. High concentrations of iron have been found in springs, wells and streams in the Carmel River basin with concentrations as high as 4.6 mg/l in some wells.

Monterey Coastal Sub-Basin

Groundwater quality is acceptable in this sub-basin.

San Luis Obispo Coastal Sub-Basin

On the average, the groundwater in the San Luis Obispo Coastal Sub-basin is the best in the southern portion of the Central Coastal Basin, although the average TDS exceeds the Public Health Service Drinking Water Standard and most of the water contains hardness in excess of the American Water Works Association hardness criteria of 80 mg/l. A summary of groundwater quality data is provided in Table 14-8. The average for TDS in the Pismo Creek Valley Groundwater basin is high reflecting 7 wells along Pismo Creek within one mile of the ocean; the TDS average for the other wells in this groundwater basin is 821 mg/l. The Arroyo Grande Valley groundwater basin has an unusually high average nitrate concentration. Thirty wells in the western Arroyo Grande Valley contain nitrate concentrations which vary from 102 to 175 mg/l. The average nitrate concentration without these wells is 28 mg/l.

Groundwaters of the Los Osos-Baywood are of exceptional mineral quality; a review of recent data (1969-1971) indicate TDS averaged 177 mg/l in this area. In contrast the Charro Basin a few miles to the north averaged 660 mg/l. These groundwaters are each used for municipal water supply.

Soda Lake Sub-Basin

The arid Carizzo Plain of the Soda Lake Sub-basin overlies a very highly mineralized groundwater basin. All constituents are high on the average but a few wells produce water with acceptable levels of most constituents. An examination of individual wells reveals that the poorest groundwater occurs in wells near Soda Lake itself along the center of the valley. Calculation of the average TDS for all wells in the basin except the nine wells near Soda Lake reveals a value of 2,196 mg/l TDS compared to an average 5,769 mg/l TDS for the entire sub-basin including these wells. See Table 14-8. Some wells up on the slopes of the valley produce groundwater which meets all the Public Health Service Drinking Water Standards.

Santa Maria River Sub-Basin

Groundwater is used extensively in the Santa Maria Valley for irrigation. The waters of the Sisquoc River which recharge the southwestern portion of the groundwater basin are of better quality than those of the Cuyama River; see Table 14-4. Consequently, downstream from the confluence of these rivers, the TDS content of the groundwater increases from 400 to 1,400 mg/l. Waters percolating through the sands of the Nipomo Mesa, in the northern part of the groundwater basin, are of relatively good quality; the average TDS for Nipomo Mesa groundwater is

Table 14-8. Groundwater Quality in the Southern Portion of the Central Coastal Basin[a]

Sub-basin/groundwater basin	Number of wells	Chloride, mg/l			Nitrate, mg/l			Boron, mg/l			TDS, mg/l			Total Hardness, as $CaCO_3$, mg/l			Percent[b] Sodium
		High	Avg.	Low	High	Avg.	Low	High	Avg.	Low	High	Avg.	Low	High	Avg.	Low	
San Luis Obispo Coastal																	
Chorro Basin	43	1110	109	24	167	16.1	0	0.55	0.07	0	2460	394	78	1300	196	29	36
San Luis Obispo Valley	39	837	171	27	270	19.2	0	1.20	0.22	0	2565	833	278	1310	466	42	31
Pismo Creek Valley	41	1844	212	24	150	18.0	0	9.50	0.54	0.03	4570	1073	307	1765	504	60	41
Arroyo Grande Valley	168	1101	93	17	175	45.0	0	0.70	0.11	0	2871	835	198	1293	511	30	23
Remainder Sub-basin	165	3927	200	0	266	12.6	0	2.92	0.25	0	7932	834	194	3928	490	13	33
Sub-basin Total	456	3927	151	0	270	25.9	0	9.50	0.20	0	7932	814	78	3928	469	13	30
Soda Lake																	
Carrizo Plain	69	32500	1116	5	206	45.7	0	16.5	2.5	0.03	94750	5769	161	7319	1404	106	67
Santa Maria River																	
Santa Maria Valley	243	850	79	14	170	17.1	0	2.51	0.21	0	6838	924	117	2956	504	23	27
Cuyama Valley	147	1333	70	7	420	26.1	0	6.90	0.40	0	5218	1634	206	2741	943	5	18
Sub-basin Total	390	1333	76	7	420	20.5	0	6.90	0.28	0	6838	1192	117	2956	669	5	22
San Antonio Creek																	
San Antonio Creek Valley	76	13700	468	29	207	13.4	0	92.0	1.84	0	38600	1652	129	9789	766	45	56
Santa Ynez River																	
Santa Ynez River Valley																	
Lompoc Sub-unit	246	16700	320	37	123	8.2	0	5.35	0.45	0.02	24034	1566	179	7040	736	36	40
Santa Rita Sub-unit	51	1361	136	27	105	7.0	0	6.20	0.58	0	5115	1089	364	3048	634	157	23
Buellton Sub-unit	12	450	86	25	77	15.5	0	1.90	0.40	0	1932	1025	290	971	616	18	20
Santa Ynez Sub-unit	40	124	47	12	54	7.6	0	1.20	0.21	0	1646	597	288	779	426	167	28
Headwater Sub-unit	7	84	30	9	7.3	1.9	0	0.84	0.19	0	1100	795	560	605	389	186	28
Sub-basin Total	356	16700	249	9	123	8.1	0	6.20	0.43	0	24034	1355	179	7040	676	18	37
Santa Barbara Coastal																	
Goleta	96	10150	367	11	72.0	5.2	0	39.0	1.15	0.02	20150	2567	327	6630	585	48	57
Santa Barbara[c]	22	17530	1096	21	1000	108.2	0	3.30	0.54	0	34634	5831	342	7578	1974	252	50
Carpinteria	35	900	91	10	117.5	23.2	0	3.00	0.39	0	1422	646	317	1070	367	12	34
Remainder of Sub-basin	69	915	159	8	97.0	7.3	0	7.70	0.79	0.01	2548	972	206	1728	471	0	42
Sub-basin Total	222	17530	331	8	1000	18.9	0	39.0	0.86	0	34634	2092	206	7578	653	0	50

[a] Source: California Department of Water Resources. Groundwater Quality Data, Central Coastal Drainage Province, Basin 3. September, 1972.

[b] Percent sodium computed from averages for sodium, calcium, and magnesium.

[c] Figures for Santa Barbara are not representative of the groundwaters used in that basin; they represent an objective analysis of all available data. Without five wells near the shore at Santa Barbara Point the TDS average of 5,831 mg/l drops to 1,056 mg/l. The same pattern is true for other constituents in this sub-basin and the values portrayed above for other sub-basins.

383 mg/l. Most groundwaters in the eastern and southern portions of Santa Maria Valley itself meet the United States Public Health Service Drinking Water Standards; the waters average 380 mg/l of hardness as $CaCO_3$, however, and are considered to be very hard. These waters are generally Class 1 for irrigation. The central portion of the Santa Maria Valley has poorer quality water. Most groundwaters fail to meet the drinking water standards for TDS; nitrate range is as high as 67 mg/l. The median hardness is 785 mg/l and the water is Class 2 for irrigation due to a high total dissolved solids content.[3] Data for the Santa Maria Valley groundwaters are summarized in Table 14-8.

The water of the Cuyama Valley groundwater basin is of poor quality primarily because of the Valley's six inch average annual rainfall. While the total dissolved solids content of groundwaters on the south side of the valley in the foothills of the Sierra Madre Mountains ranges as low as 400 mg/l, some wells in the northeastern portion of the valley near the Caliente Range produce water with up to 6,000 mg/l TDS. See Table 14-8 for additional data. Groundwater in the Cuyama Valley has been used to irrigate most crops. Presumably this has been possible because the waters exhibit low sodium levels and because the soils are quite permeable which prevents a build-up of salts in the root zone.

San Antonio Creek Sub-Basin

The groundwaters in the San Antonio Creek Sub-basin are of quite variable quality. East of the community of Los Alamos, the groundwater total dissolved solids content is below 400 mg/l in several wells. Downstream from Los Alamos, the quality becomes increasingly worse as water flows through the aquifer. Between the small town of Casmalia and Point Sal in the northwestern portion of the sub-basin, the groundwater is of very poor quality; total dissolved solids range up to 8,040 mg/l. Computation of the average TDS for this groundwater basin without six wells in the northwestern area yields a value of 673 mg/l, compared to 1,652 mg/l for the entire groundwater basin. See Table 14-8.

Santa Ynez River Sub-Basin

The data for each hydrologic sub-unit in the Santa Ynez River Valley groundwater basin has been presented separately in Table 14-8. The sub-units are analyzed in sequence; the Lompoc sub-unit is the farthest downstream. An examination of this portion of Table 14-8 shows that groundwater quality decreases as the water flows through the aquifer and picks up constituents from the aquifer minerals and from the recharge of agricultural waters and possibly from percolation of municipal wastewaters. In the Lompoc area, groundwater is of moderately poor quality. Groundwaters with a high total dissolved solids content exist in wells near the coast. The Lompoc groundwater basin averages 1,566 mg/l TDS. A few wells north of Lompoc produce waters with less than 500 mg/l total dissolved solids. When the worst 12 wells are discounted the average TDS falls to 1160 mg/l.

Santa Barbara Coastal Sub-Basin

Groundwater in the Santa Barbara Coastal sub-basin is highly variable, depending for the most part on the proximity of the wells to the ocean. Data are presented in Table 14-8. In the Goleta groundwater basin, the average TDS drops from 2,567 mg/l for the entire basin to 1,670 mg/l if six wells near Goleta slough are eliminated from the average. Similarly, in the Santa Barbara groundwater basin the average TDS for the entire basin is 5,831 mg/l; without five wells near the shore at Santa Barbara Point the average drops to 1,056 mg/l. Most wells in the groundwater basin range from 475 to 650 mg/l total dissolved solids. The nitrate average for this basin is 108.2 mg/l; if Veronica Springs and a nearby well, with nitrate concentrations of 991 and 974 mg/l, respectively, are eliminated from the computation, the average becomes 20.8 mg/l.

PRESENT AND POTENTIAL PROBLEMS

Many of the problems mentioned in the following sections were identified by the State Departments of Fish and Game, Public Health, and also by the State Department of Conservation, Division of Forestry and Division of Oil and Gas. Specific problems were related to existing water quality by reference to reports of the State Department of Water Resources and the Regional Water Quality Control Board.

Surface Water Quality Problems

The principal surface water quality problems in the Central Coastal Basin involve the siltation of reservoirs and stream beds and the discharge of untreated or partially treated agricultural, industrial and domestic wastewaters to the surface waters of the basin. Eutrophication of the lower portion of such waters of the lower Salinas River and San Luis Obispo Creek has occurred as a result of waste discharges. Contamination of local coastal waters has occurred. Problems are discussed below by sub-basin; some of these conditions are of a minor or problematical nature but are included to provide a complete record.

Problems from Point Sources

Water quality problems and violations of established water quality control plans do occur in the Central Coastal Basin as a result of municipal and industrial sewage and refuse disposal operations. Many of these problems occur in wet weather where sewerage facilities are inadequate to cope with infiltration or where communities rely on individual septic tank and percolation systems. Problems associated with ocean disposal occur for various reasons relatable to inadequate treatment or outfall design and location.

Santa Cruz Sub-Basin. Sewage discharge from the small community of Davenport is collected, given minimum treatment and discharged to the ocean near the shore line at the base of a steep cliff. Since the discharge is in an inaccessible location, and is diluted by groundwater seepage prior to discharge, the immediate nature of the problem is not severe although technically this discharge is not meeting the State's ocean plan requirements. Placed in perspective this is a low priority case.

San Lorenzo River Sub-Basin. With the exception of four subdivisions and two municipalities, all of the San Lorenzo River Sub-basin is served by individual sewage disposal systems. Failures in the more densely populated areas have been reported by the State Department of Public Health. Special studies have been made and verification of this condition has not been determined by Regional Board staff. In addition, poor logging practices in this area may result in barriers to fish migration and cause further water quality degradation adversely affecting trout fisheries in the San Lorenzo River Sub-basin.

Aptos-Soquel Creeks Sub-Basin. Domestic waste discharges north to Monterey Bay from the Aptos and East Cliff County Sanitation Districts cause the primary water quality problems in this sub-basin since their outfalls terminate in the shallow waters of Soquel Cove where currents are weak. Beaches and waters in the vicinity of the outfalls receive a high degree of use. However, plans are underway to eliminate the discharges by exporting the wastewaters to Santa Cruz for treatment and disposal through the City of Santa Cruz's outfall off Pt. Santa Cruz.

Pajaro River Sub-Basin. Municipal and domestic wastewaters are a source of water quality problems in the lower Pajaro River and the nearshore waters of Monterey Bay. Shellfish harvesting is a major beneficial use of the nearshore waters of the bay, and occasional overflows from sewage pump stations and inadequately treated sewage discharges have threatened to contaminate these waters. In 1972, a system failure in the Watsonville plant caused a bypassing of raw wastewater into the Pajaro River resulting in a fish kill.

Salinas River Sub-Basin. Overflows from waste treatment ponds along the Salinas River from Chualar to the San Luis Obispo County line discharge to the river during high water conditions. The City of Salinas discharges effluent to the Salinas River which together with agricultural drainage and other sources compounds eutrophication related problems in the Salinas River Lagoon. This reach of the Salinas River below the Spreckles gage was considered as a water quality class situation however this is not being recommended. See Chapter 15. In the Moss Landing area, water quality problems in the recent past revolved about Elkhorn Slough where industrial, vessel and dairy wastes were to blame.

On the Monterey Peninsula, discharges from Ft. Ord, Seaside and Monterey into the South Monterey Bay pocket area are in violation of the Regional Board's prohibition of discharge policy. The beaches and waters of the area affected by the discharge are used heavily for water contact recreation. A total of eleven major municipal dischargers have been using Monterey Bay for effluent disposal; most of the outfalls are in shallow waters with poor dispersal characteristics. In the recent past (1969) water quality near beaches in the southern area of Monterey Bay was found to be contaminated and disinfection practices were required to be upgraded.

Carmel River Sub-Basin. Potential salt balance problems exist in the lower Carmel Valley and must be considered in all future wastewater and water supply development plans. Water quality problems exist in the Carmel Valley where lack of sewers represents a potential health hazard and threat to water quality unless provisions are made to prevent failure of individual sewage disposal systems.

Monterey Coastal Sub-Basin. In the Carmel Highlands area domestic wastes from individual residences are discharged to the ocean with minimal treatment. Although the volume of wastes is small and the discharge areas are inaccessible, the discharges create potential health hazards and may create local nuisance conditions. More recently, water quality problems have occurred due to the high incidence of permanent camp sites without sanitation facilities in the Big Sur area. Wastes are coming into contact with surface waters creating a health hazard, particularly during the summer tourist season.

The main problem seen for this sub-basin in the future concerns the recreation waste loads that are now beginning to be a problem. Control of recreational activities and/or provisions for collecting wastes will be required for the protection of the surface water quality of this sub-basin.

San Luis Obispo Coastal Sub-Basin. The San Luis Obispo County Engineer has indicated that untreated wastewater is evident in the roadside ditches throughout the residential areas of the community of Cambria.[6] The Cambria County Water District is now in the process of sewering about half of the community to help alleviate the problem. The failure of septic tank leaching systems can cause the surface ponding of wastewaters, and public contact with this effluent is a significant health risk.

Various water quality problems occur in the San Luis Obispo Creek area due to both point and non-point waste sources. These problems include excessive eutrophication in the impounded segment of the lower reach near Avila Beach; nutrients from effluent discharged from the City of San Luis Obispo treatment plant and from agricultural activities contribute to this problem. The extent of nuisance on water quality impairment can be judged differently depending on beneficial uses to be protected; some discussion of the tradeoffs involved in water quality control in this reach is provided in Chapter 15. Other water quality related problems in this reach have been associated with inadequate disinfection of contaminated waste sources, salinity due to high salt content of effluents discharged relative to "natural" steam quality and the increased sensitivity of the lower reach caused by the impoundment of these waters.

Soda Lake Sub-Basin. No surface water quality problems due to man's activity are apparent.

Santa Maria Sub-Basin. Municipalities, such as the City of Guadalupe, dispose of undisinfected secondary effluent by spray irrigation. During periods of wet weather, it is possible for these wastes to travel overland to the Santa Maria River. The Department of Public Health has warned of a potential disease risk from public contact with this waste during periods of wet weather.[7] Adequate provision has not been made to prevent bypass of untreated sewage from the Lopez Recreation Area due to mechanical or power failure.

San Antonio River Sub-Basin. No surface water quality problems were evident in this area.

Santa Ynez River Sub-Basin. Inadequate flood protection of several municipal wastewater treatment plants in the basin presents potential water quality problems. For example, the wastewater treatment plants of the communities of Lompoc and Mission Hills are located on the flood plain of the Santa Ynez River and are therefore subject to inundation during periodic flooding of the river. A separate but related problem, that of excessive wet weather infiltration into sanitary wastewater collection systems, occurs in several communities in the basin which can contribute to overloading at treatment works causing degradation of effluent quality.

Santa Barbara Coastal Sub-Basin. A biological and visual diving survey by the Regional Water Quality Control Board has shown that the existing municipal discharge of the City of Santa Barbara has degraded the environment in the vicinity of its ocean outfall. Animal populations were significantly decreased and a heavy blanket of wastewater solids was deposited within a radius of 1,000 feet of the outfall.[8] The City of Santa Barbara has proposed the expansion and improvement of its plant to improve its effluent quality; these and other improvements as well as deficiencies noted at other treatment plants in this area are described in chapter 16.

Problems from Non-Point sources

Many water quality problems occur as a result of activities which cause a more diffuse entry of wastes to surface waters than those born in outfall pipes or similar drainage conduits. In rural areas problems more often originate from road construction, mining, forestry or agriculture practices. These kinds of non-point problems are described below.

Estuaries, lagoons and marshes provide habitat for many migrating California waterfowl. These areas are also known to be among the most productive habitats in terms of wildlife food and populations. Because of their natural beauty, recreation potential, and proximity to urban areas, these vital wetlands are potentially threatened with thoughtless "development." Although the current use of these areas has caused no apparent problems, their possible misuse must be considered a potential water quality problem. Significant wetlands occur at the mouths of many of the basin's streams. Morro Bay at the mouth of Chorro Creek is a prime example.

Non-urban runoff and the erosion and siltation that occurs during and after storms contribute a significant waste load to the basin. Sediment accumulation in streams changes their flow and velocity characteristics. When a sediment laden stream enters a reservoir, the reduced velocity causes the water to release its sediment load. Silting up of the reservoir occurs more rapidly and reduction of the reservoir's capacity occurs at a faster rate than it ordinarily would. Tests by the United States Geological Survey indicate, for example, that in the 1968-69 water year, about 84,000 tons of sediment were introduced to Lopez Reservoir. Changes in the rate of the introduction of silt to reservoirs can significantly affect the useful life of such projects.

In the San Lorenzo River Sub-basin, erosion resulting from road building, subdivision construction and logging operations has been a problem for some time. It is compounded in the San Lorenzo Valley because of soil types and the high intensity rainfalls.

Erosion resulting from man's activities has become a serious problem in the Llagas and Uvas Creek watersheds. Illegal grading in many areas now threatens to hasten the natural process of siltation in both Chesbro and Uvas Reservoirs.

The Division of Forestry has indicated that consistant over-grazing by cattle and sheep has aggravated the problem. The compaction of the soil caused by the trampling of hooves reduces infiltration rates and the resultant high surface flows lead to erosion and sediment transfer to streams and rivers. The Division of Forestry has identified three areas that are consistently overgrazed in the southern Central Coastal Basin: the coastal bench from Cayucos north, the intermountain valleys northeast of the Sierra Madre Mountains, and the lowlands of the Santa Maria and the Santa Ynez River Valleys.[9]

Sedimentation problems are associated with construction for the realignment of State Highway 166 in the Cuyama Canyon upstream of Twitchell Reservoir. Steep cuts in the hillsides have removed the sediment-holding vegetation and the sheet erosion will be greatly accelerated until the vegetation is fully restored.

Serious problems of excessive erosion and sediment transfer arise from high intensity fires which burn away the protective vegetative ground cover. United States Forest Service studies[1,2] show that destruction of watershed cover by fire increases runoff by 15 to 20 times and erosion of valuable top soil by 100 to 1,000 times. The State Division of Forestry has reported that an average of about 27,000 acres of vegetative ground cover was lost to fires annually in the Central Coastal Basin during the 10-year period of 1961 to 1970. The impact of fires on the storage capacity of Gibraltar Reservoir on the Santa Ynez River is well documented.

Following major fires which occurred in 1932 and 1933, the United States Forest Service, in cooperation with the City of Santa Barbara took steps to control erosion by constructing Mono and Caliente Debris Dams in the Gibraltar watershed. The combined debris storage capacity of these two dams is 1,080 acre-feet. Both debris basins were completely filled with silt within a very few years after completion. By 1947 the storage of Gibraltar Reservoir had been reduced from its original volume of 14,500 acre-feet to 7,620 acre-feet. In that year the dam was raised to restore its original storage volume.

The presence of silt and debris in runoff entering Gibraltar Reservoir has continued to reduce the available storage volume. In September 1964, the problem was compounded by the destruction accompanying the Coyote Fire which burned along a 160 mile perimeter over approximately 105 square miles of land. Included in the area destroyed were approximately 36 square miles, 17 percent, of the Gibraltar watershed. Following the fire, the Forest Service again constructed debris dams with cooperation from the city. Three dams, with a combined capacity of 2,250 acre-feet, were constructed.

On the basis of reservoir surveys conducted between 1920 and 1956, the amount of sediment reaching Gibraltar Reservoir each year has averaged 215 acre-feet. This amount represents a unit quantity of about 1.0 acre-foot per square mile each year, after accounting for debris storage in basins located throughout the watershed. The

United States Forest Service has estimated[10] that average annual debris production can be reduced to about 60 acre-feet, or 0.28 acre-feet per square mile, if adequate fire control and land treatment measures are constructed in the watershed.

Sediment loads to streams and impoundments are increased by construction activities associated with urbanization. The cuts, fills and bare slopes associated with the building of roads and highways are also sources of erosion and sediment loads.[9] It is estimated that urban area will increase from 64,300 acres in 1970 to 121,500 acres in the year 2000. Without proper erosion controls, water quality problems may result.

The production of oil and gas presents potential surface water quality problems. The oil and gas industry in California obtains its production generally from formations of marine origin. These marine deposits contain connate waters with high concentrations of dissolved mineral salts and the production of oil and gas results in an associated production of quantities of highly saline wastewater, oily wastes and other chemical wastes. Generally, waters produced in association with oil and gas contain significant amounts of the ions of sodium, calcium, chloride, carbonate, boron, sulfate and iodine. Trace amounts of such elements as potassium, magnesium, mercury and flouride are often present. Besides the obvious effects that highly saline waters have on vegetation, boron has a particularly deleterious effect on plant growth at very low concentrations. Its presence in excess quantities in waters used for irrigation greatly limits the usefulness of the water supply. In 1970, 180 million gallons of oil and gas production wastewater were disposed of by evaporation from sumps in the southern Central Coastal Basin. Overflows from the sumps during wet weather and leakage through the walls and bottom of the sumps, are possible sources of degradation of the mineral quality of surface waters. However, because of voluntary industry compliance with standards established by the State Division of Oil and Gas, serious problems have been averted. For example, in December of 1971 there were nearly 200 sumps on properties operated by the Union Oil Company of California in the Santa Maria River Sub-basin. In reaction to a Division of Oil and Gas program of sump cleanup, more than 90 percent of the sumps were abandoned by mid-1972." The remainder (about 15) are scheduled to be abandoned or lined with plastic by 1977.

In the Arroyo Grande oil field, oil production wastewater is being discharged into injection wells which return wastewaters to the oil producing zone. In previous years the discharge was to Pismo Creek. A chemical analysis of the discharge conducted by the Department of Water Resources in 1963 indicated that it contained sodium, chloride, boron and total dissolved solids at a concentration 775, 736, 5.3 and 2,246 mg/l respectively. The discharge volume was 5 mgd in 1961.[12]

A more widely publicized water quality problem associated with oil and gas production is the increased risk of oil spills and blowouts. In 1970, 21 million barrels of crude oil and 63 billion cubic feet of natural gas were produced in the southern Central Coastal Basin[13] A significant amount of this oil and gas is produced on offshore platforms and a large amount is transported by ocean-going oil tankers. These activities pose potential water quality problems and have been the subject of many continuing industry, government, and environmental group studies. The January 28, 1969 Santa Barbara Channel oil spill serves as a reminder that significant (one to three million gallon) oil spills are possible. The relatively short-term effect of spills and blowouts are well documented but very little is known about the low-level, long-term effects. It is encouraging to note that a study sponsored by the Environmental Protection Agency of macroplankton, fish and large invertebrates living near the Santa Barbara blowout before and one month after the spill has discovered no significant changes in species diversity, evenness of abundance or overall abundance.

The Division of Oil and Gas has stated that in a few instances "sloppy house-keeping" on offshore platforms has resulted in minor oilspills and in the discharge of inadequately treated wastewater containing particulate matter which has adversely affected ocean color. The Department of Public Health has pointed out that these same discharges damage aesthetic and recreational use of the beaches when these materials are washed onshore.[7] Damage to seabirds, the aesthetic and recreational uses of beaches and possible long-term toxic effects of oil make it wise to be rigorous in the prevention of future oil spills, either from tankers or from oil well blowouts.

Onshore oil production can also cause surface water problems. Drainage should be controlled around oil field sumps containing brines and oily wastes. Ponds used to store oil field wastewaters can become death traps for waterfowl which may be attracted to these placid but treacherous waters.

There are natural oil seeps on land and in the waters offshore from the Santa Barbara Coastal Region; these natural seeps have been recognized since early times; records predate the construction of the Santa Barbara Mission in 1786. Seepage from Coal Point, a major oil seep area, has been estimated at about 100 barrels per day. The presence of natural oil seeps complicates the problem of identification of oil spills at sea from drilling platforms and passing ships; however, there are analytical techniques that can be used to "fingerprint" oils; thus permitting enforcement of federal oil spill statutes.

Extensive use of land and water for agriculture in the southern Central Coastal Basin has resulted in several water quality problems. In general, the more significant agriculture-related surface water problems include the discharge of nutrients and pesticides from irrigated lands in runoff and the discharge of nutrients, oxygen-demanding substances and bacterial contamination from areas used for intensive livestock production. For example, the State Public Health Department has noted that bacterial contamination of Morro Bay occurs during wet weather due to runoff containing animal wastes from dairy farms along Chorro and Los Osos Creeks. This contamination of the waters of the bay threatens the health of the users of the bay and increases the danger of pathogenic contamination of the shellfish that are propagated there.[7]

A large feedlot on Nipomo Mesa has a surface runoff problem during wet winter surface runoff periods. The feedlot is located on a hillside and the surface runoff passes through the corrals, as well as the manure stockpile area, to discharge into Los Berros Creek. Check dams have been installed to impound the runoff but they are undersized. Direct discharge continues to occur during storm periods. A similar but much smaller problem exists in the Cuyama Valley.

Another example of the type of water quality problem that faces such an intensely agricultural area is the problem of inadequate facilities and handling procedures used for loading pesticides on crop spraying aircraft at the Oceano Airport.[7] The situation has resulted in pesticide spills and contamination of Arroyo Grande Creek and the beach area at the mouth of the creek. It exposes the recreational users and shellfishermen in that area to possible health hazards and is detrimental to the aquatic environment.

Vessel wastes are a problem in many of the marina areas. State and federal policy are causing a gradual shift from once through systems to holding tanks. The effectiveness of holding tanks will depend upon the installation of dockside pumpout facilities.

Problems from abandoned mines can be greater than those from active. Leachants from tailings or abandoned mine shafts may percolate into groundwaters or discharge into surface waters. Absentee owners may be a widely scattered corporation which hinders cleanup proceedings by the regional board. One such problem area is the Sunbird Mercury Mine on the south side of Gibraltar Reservoir. A flood shaft and percolation through the leachant has resulted in the discharge of mercury concentrations of .008 and .01 mg/l, which exceeds the discharge requirements of .005 mg/l. Waters in Gibraltar Reservoir are used for municipal supply in the Santa Barbara area and .005 mg/l is the public health limiting concentration for domestic water supplies. The Board is taking action to alleviate the problem.

Groundwater Quality Problems

Man's activities and the geologic environment combine to create groundwater quality problems in many areas of the Central Coastal Basin. Because groundwaters supply the major proportion of the waters used for domestic, industrial and agricultural purposes in the basin, the quality of these waters must be safeguarded.

Groundwater quality has been discussed in earlier sections of this chapter; available data indicate no major problems occur in groundwaters in the Santa Cruz Coastal Sub-basin; the San Lorenzo River Sub-basin or the Aptos-Soquel Creeks Sub-basin. In the Pajaro River Sub-basin there are extreme variations in groundwater quality.

Problems are evident in the Hollister and Tres Pinos area groundwaters, due primarily to complex local geology. There is a possibility that degradation of groundwater quality could be caused by the City of Hollister's industrial waste disposal ponds, as the water supply wells used by the canneries in Hollister are located in the highly mineralized groundwater basin on the east side of the Hayward Fault, whereas the industrial waste ponds are located west of the fault over a good quality groundwater basin. Thus, the continued operation of the industrial disposal system results in the transfer of highly mineralized water from its natural basin into another basin that is less mineralized.

Groundwater quality problems in the Salinas River Sub-basin were described earlier in the section on existing groundwater quality; these include examples of natural impairment due to recharge of highly mineralized surface waters from San Ardo to Greenfield. Three other problems cited include a salinity mound near Gonzales, a salt buildup in the 180 foot aquifer around Salinas and sea water intrusion along the coast.

A simplified conjunctive-use operation is presently employed in the management of the Salinas Valley groundwater basin. Dams have been constructed on two of the four major rivers tributary to the basin, the Nacimiento and San Antonio Rivers. These dams are operated for flood control, recreation and water supply. All of the yield from these dams is presently used for groundwater recharge. Winter flood flows are captured and released in the summer for recharge in the upper Valley and Forebay aquifers. Releases are controlled so that the Salinas River flows just to Gonzales at the downstream edge of the Forebay aquifer.

The Forebay aquifer acts as the major present-day source of recharge to the downstream confined 180-foot and 400-foot aquifers. Historically, the East Side aquifer also served as a forebay to these confined aquifers. Recent heavy groundwater extractions have, however, given this unit an adverse hydrologic balance. The East Side aquifer is now drawn down to the point of reversing the hydraulic gradient from adjoining pressure aquifers.

This phenomenon has a profound effect on the present hydrologic and water quality conditions in the pressure aquifers. The 180-foot and the 400-foot aquifers are long and narrow and receive all of their recharge at one end while most of the extractions occur at the other end. As the Forebay aquifer is being maintained in a full condition by the groundwater recharge operation, the pressure head at the upstream end of the 180-foot and 400-foot aquifers cannot be increased. Therefore, the only way that increased extraction rates can be accommodated under existing management practices is by a lowering of the piezometric surface table which gives an increased hydraulic gradient.

Protection of groundwater quality is made more difficult by the existence of certain natural geologic processes which significantly lower the mineral quality of groundwaters in the basin. For example, the hardness (calcium-magnesium-bicarbonate hardness) of much of the water in the basin is due to the solution of minerals from the Jurassic rocks which form the coastal hills and mountains.

The quality of groundwaters is also naturally impaired in those areas where saline deposits yield minerals to it readily. Wells along the coast from San Simeon to Arroyo Grande occasionally reveal impairment from saline deposits.

Another natural geologic process which lowers the mineral quality of groundwaters is the migration of deep-seated and connate waters into upper aquifers. These deep-seated waters are of volcanic or other deep geologic origin and are sometimes confined under high pressure and temperature. Water trapped in sediments during deposition is called connate water; since most sedimentary rocks are laid down under seawater, connate waters are usually quite saline. If the hydraulic or geologic conditions which confine these highly mineralized waters change, such as the lowering of the water table or shifts in faults, it is possible for them to move into and degrade fresh water aquifers.

Well water and hot sulfur springs emanating from Miocene rocks in the Pismo Beach-Arroyo Grande area, for example, contain concentrations of TDS and sulfate which range from about 500 to 900 and from 50 to 300 mg/l, respectively. This water is also elevated in temperature and clearly exhibits the impact of deep-seated, volcanic waters on groundwater quality.[15] In the Lompoc area, by contrast, the migration of saline connate waters from pre-Quaternary sediments in the highland areas is thought to be a possible source of the 700 to 2,000 mg/l of TDS that limit the usefulness of groundwaters in that area.

Water from wells near the Caliente Range in the northeastern part of the Cuyama Valley contains 3,000 to 6,000 mg/l of TDS, up to 1,000 mg/l of chloride and 15 mg/l of boron. The very poor quality of this water is probably due to the mixing of connate waters with percolating fresh waters. In the central part of the valley, TDS is in the 1,500 to 1,800 mg/l range, and the groundwater is very hard. This water is successfully used for irrigation, presumably because the sodium percentage is low enough to allow good soil drainage. A few wells on the slopes of the Sierra Madre Mountains contain between 400 and 700 mg/l total dissolved solids. Water quality for the valley is expected to degrade because groundwater gradients favor movement of the brackish waters in the northeast slopes of the valley to areas of greatest drawdown in the center of the valley.[16]

Groundwater in the lower San Antonio Valley is used predominantly for stock watering because of its poor quality. The source of this degradation is saline connate water.

Man's activities in the basin have also caused problems associated with the infiltration of inadequately treated agricultural, municipal and industrial wastewaters and with the overdraft of groundwater basins.

In many areas of the Central Coastal Basin, irrigation is important to agricultural productivity. Much of the applied irrigation water evaporates, causing an accumulation of salts in the soil. To prevent salt buildup and damage to crops, excess water is applied to leach these salts out of the root zone. These salts eventually find their way into the groundwater basin and usually increase the concentration of such constituents as TDS, sodium, hardness, sulfate and chloride. Nitrate and phosphate fertilizers are applied to the fields and percolate with this excess applied water or irrigation return flow. Phosphates present no water quality problem because soil clay colloids readily absorb this chemical; nitrates, though, readily travel through the soil and the contribution of nitrate to groundwater by irrigation return flow can be quite substantial in intensively agricultural areas.

Animal wastes produced in feedlots are usually allowed to accumulate on the feedlot or are spread on a land disposal site. Leaching of the degradation products of these wastes can create groundwater quality problems. Nitrate is produced in large quantities in the aerobic decomposition of these wastes.

Infiltration of septic tank leachates from urban areas and irrigation return waters in the Los Osos area have contributed to groundwater chloride concentrations in excess of 100 mg/l and to nitrate concentrations up to 90 mg/l from some wells.[17] Nitrate concentrations above 45 mg/l in wells in the lower aquifer under Arroyo Grande Creek, in the small mesa between Grover City, Oceano and Arroyo Grande, and in the northern portion of the Nipomo mesa are due in part to percolation of irrigation return water.[18] Extensive use of nitrogenous fertilizers throughout the Santa Maria Valley is a probable source of localized high nitrate concentrations in the groundwater. Groundwaters in the area northeast of Guadalupe exhibit nitrate concentrations as high as 105 mg/l and TDS concentrations up to 6,838 mg/l. In the eastern part of the valley, groundwater samples have had concentrations as high as 1,841 mg/l and nitrate concentrations as high as 79 mg/l.[2]

The production of crude oil and gas results in the associated production of wastewater which is usually highly saline. It is disposed of in two ways, by injection to deep, non-fresh water aquifers or discharged to sumps for percolation. Care must be taken in well construction to prevent contamination of fresh water aquifers. Similarly, precautions must be taken to prevent brine in sumps from percolating to fresh groundwater basins.

The Division of Oil and Gas regulates the disposal of oil field wastes in sumps and injection wells. The Division of Oil and Gas also reports that, as of December 1972, sumps in the Guadalupe oil field were percolating waste-waters into strata which are in hydraulic continuity with fresh water strata. The Division reports that wastewater injection pressure in the west portion of the Cat Canyon oil field is exceeding the surrounding hydraulic pressure but that no evidence of contamination of adjacent aquifers has been found.[11]

In several areas of the basin, man and his activities are demanding water supplies in excess of what the groundwater basins in these areas can naturally supply. In some areas, excessive pumping, or overdraft, of groundwater can lower the water table to the extent that more highly mineralized water from an adjacent aquifer is able to flow into a higher quality groundwater basin. In a similar way, overdraft of an aquifer that opens to the sea can reverse the hydraulic gradient and cause sea water to intrude into the fresh groundwater. An increase in total dissolved solids, especially chloride concentration, with time is indicative of sea water intrusion.

Sea water intrusion has occurred in the groundwater basin underlying Morro, Chorro, and Los Osos Creeks near Morro Bay; there are no stratigraphic barriers to groundwater flow so a lowering of the water tables has allowed the landward flow of sea water. The intrusion has occurred in only the coastal extremities of each groundwater basin and fluctuates in response to pumpage flows and seasonal subsurface flows.

Part of the increase in TDS and chloride concentrations, which are used as indicators of sea water intrusion, could be due to dissolution of evaporite deposits in the nearshore alluvial deposits of the Chorro and Los Osos groundwater basins.[17] There is also some evidence of salinity buildup at the mouth of the Santa Ynez River, but its extent is not known.

Groundwater in the vicinity of Arroyo Grande and Pismo Creeks contain high chloride concentrations but historic water table levels preclude sea water intrusion. Migration of connate waters, evapo-transpiration, and percolation of sea water on tidal channels during extremely high tide are probable causes of these high chloride concentrations.[18] There is limited evidence for sea water intrusion north of Pismo Creek but it is thought to be minor.

There are areas in the basin where lack of adequate water supplies has already limited development. The Cuyama Valley, for example, has a serious overdraft problem. The United States Geological Survey estimates the overdraft at 21,000 acre-feet per year with an average decrease in the water table of 2 to 8 feet per year. The Soda Lake sub-basin has a closed groundwater basin with no outflow. Consequently, evapotranspiration, leaching, and other natural processes that operate in an arid area cause the groundwater to be of increasingly poorer quality with no possibility of flushing.

In certain areas of the basin, municipal and agricultural wastewaters, as well as impounded surface waters are recycled by allowing them to recharge groundwater basins. Since each cycle of water through a city or farm adds an increment of dissolved salts, the concentration of salts in the aquifer tends to increase. In most cases, the quality of water supplies is moderately poor due to low natural rainfall and geologic conditions and an excessive increase in its dissolved solids content during its first use could make the wastewater quality unacceptable for some uses.

In the Santa Maria Valley, for example, four municipal wastewater treatment plants dispose of their effluent on land. In addition, irrigation return flows add substantial amounts of water to the underlying aquifer. In a report for the Regional Water Quality Control Board, the State Department of Water Resources attempted to discern any deterioration in the quality of the groundwater in the Santa Maria Valley from 1964 to 1969.[21] The report noted rising water tables in the western portion of the valley have prevented sea water intrusion but that groundwater nitrate concentrations as high as 120 mg/l have been found near the Santa Maria wastewater treatment plants percolation ponds. Analyses of the great variation in nitrate and chloride concentrations show that levels of those two constituents increase with proximity to the City's percolation ponds to average levels of about 75 mg/l and 250 mg/l, respectively. Although the discharge from the City's ponds is increasing groundwater nitrate levels, it should be noted, however, that DWR suggested that contributions from nitrogenous fertilizers used in the Valley were a more significant source of nitrates.

Individual wastewater systems also contribute to the impairment of groundwater quality. Problems occur in the Arroyo Grande area due to excessive nitrates in groundwater. The use of individual waste disposal systems must be reviewed on a case-by-case basis as local soil topography and drainage conditions as well as population density and water use influence the effect percolation systems have on local groundwaters. For example in the Los Osos-Baywood area groundwater quality generally has been excellent through the 1960's and nitrate buildup above 45 mg/l is apparent in only a few wells; most wells indicate nitrate levels are less than 20 mg/l. However, increased development of this area threatens to impair mineral quality of local groundwaters.

Mining presents another possible source of groundwater quality problems. Several heavy metal mines are in operation in the South Central Coastal Basin and the often toxic metal ions from these mines could find their way to groundwater basins. The solubilities of these heavy metal ions are usually much less than the solubilities of metal ions such as sodium and magnesium and a knowledge of the detailed geochemistry of the area is necessary to determine their rates of infiltration and their impact on groundwater quality.

Heavy metals are also introduced to the surface and groundwaters of the basin by runoff from urban areas and by discharges from municipal wastewater treatment plants. Table 14-9 is a compilation of available heavy metal concentrations in the wastewater effluent of some municipal wastewater dischargers in the basin. Those wastewaters discharged to the ocean are required to meet effluent quality requirements of the SWRCB Water Quality Control Plan for Ocean Water of California adopted in July, 1972. The

United States Public Health Services Drinking Water Standards for heavy metals are included in Table 14-9 for comparison with the discharges of inland municipalities because some of these waters are disposed of on land and their heavy metals could find their way into public water supplies.

It is evident that the wastewater effluent from several of the ocean dischargers does not comply with the heavy metal effluent water quality requirements of the State Ocean Plan and that the wastewater effluents of several inland dischargers would not be acceptable as drinking water, on the basis of their heavy metal concentrations.

Solid wastes are usually disposed of in an excavated sanitary landfill which is covered over with soil. The sites are usually above the groundwater table and attempts are made to prevent leaching by sealing the site. However, the potential exists, if water percolates through the sanitary landfill, for an increase in the groundwater of hardness, total dissolved solids, oxygen-demanding substances, acidity, and alkalinity.[20] As buried solid wastes decompose, carbon dioxide is formed and the dissolution of soluble mineral constituents is increased, thus compounding the problem.

The groundwater resources of the Santa Maria River Sub-basin are in the range of 79,000-83,000 acre-feet per year as a safe yield. Net water use as computed by the Department of Water Resources was 103,800 acre-feet in 1968; independent net water use estimates made during the basin planning work tabulated in Chapter 13 were 104,700 acre-feet per year in 1970 and reach 136,100 acre-feet per year by the year 2000. Clearly the Santa Maria area is in an overdraft condition which will worsen in the future. Continued degradation of the groundwater quality can be expected until such time quality impairs use sufficiently to either reduce pumping or force development and importation of new supplies. Water reclamation is currently practiced in the Santa Maria Valley where mineralized wastewaters are returned to the land; this is helping the water balance conditions, but excessive salinity of these municipal effluents aggravates the mineral buildup problem.

The problem of inadequate water quantity could be alleviated for a time by recycling. However, an adverse salt balance in many groundwater basins is likely to degrade water quality. Advanced wastewater treatment methods, such as biological denitrification and demineralization, importation of replacement water supplies, recharge operations or deportation of poorer quality waters are some methods that are available to assist in reversing an adverse salt balance.

FUTURE IMPACT OF PROJECTS ON BASIN HYDROLOGY

The streams of the Central Coastal Basin are for the most part ephemeral and low flows during prolonged dry periods are usually unmeasurable. Many streambeds are totally dry through much of the summer except immediately downstream of reservoir releases, municipal waste discharges or heavily irrigated areas. Development of additional storage reservoirs will not necessarily change this seasonal critical low flow condition; in fact importation of water may augment low flows in some areas as a result of reservoir releases.

Groundwater degradation has occurred in the basin, notably in the Salinas River Sub-basin, the Santa Maria Valley and the Santa Ynez River Sub-basin area. The Salinas River Sub-basin requires several methods of water quality management; water resource projects could be used to assist in salt routing in the eastern side of the Valley and to provide replacement supplies to correct overdrafts in downstream areas. Adjudication is a possibility if overdrafts are not corrected through other means. Similarly water projects should be considered as means to improve groundwater quality through correction of overdrafts in the Santa Maria and Santa Ynez Sub-basins. This improvement in groundwater quality could be accomplished through direct aquifer recharge and through improvement of municipal and agricultural water supply quality. Such improvement will eliminate the need for water softeners in these areas and thus lessen the total salt load carried in municipal wastewater effluents. Substitution of imported water for mineralized groundwaters will decrease the areal salt emission applied on agricultural lands which will have a long term beneficial effect on groundwater quality.

Future Water Availability in the Central Coastal Basin

Possible future sources of water supply to the Central Coastal Basin include imported water, weather modification, watershed management, groundwater basin management, development of local surface runoff, desalination, and reclamation of municipal and industrial wastewater. It should be emphasized that more efficient use of existing water resources within the basin, as for example

Table 14-9. Heavy Metal Analyses of Municipal Wastewater Effluents[a]

	Disposal Area	Date Sampled	Arsenic mg/l	Cadmium mg/l	Total Chromium mg/l	Copper mg/l	Lead mg/l	Mercury mg/l	Nickel mg/l	Silver mg/l	Zinc mg/l
United States Public Health Service Drinking Water Standards			0.01	0.01	0.05[g]	1	0.02	none	none	0.05	5
Ocean Plan Effluent Quality Requirements[b] 50%			0.01	0.02	0.005	0.2	0.1	0.001	0.1	0.02	0.3
10%			0.02	0.03	0.01	0.3	0.2	0.002	0.2	0.04	0.5
Sub-basin/municipality											
San Luis Obispo Coastal											
San Simeon Acres	ocean	12/70	0.01	0.00	0.000[g]	0.05	0.00	<0.001			0.15
Morro Bay-Cayucos	ocean	11/72	0.004	0.011	0.02	0.08	0.066	0.001	0.074	0.012	0.24
Camp San Luis Obispo	land	12/70	0.00	0.00	0.000[g]	0.01	0.00	<0.001			0.04
Avila Beach	ocean	12/70	0.01	0.00	0.000[g]	0.04	0.02	<0.001			0.10
Santa Ynez River											
Lompoc	land	1970	<0.02		<0.01[g]		<0.01	0.002			
		12/71	<0.02	<0.05	<0.01[g]		<0.20				
		6/72	<0.01	<0.01	<0.01	<0.01	0.08	<0.001			0.06
Vandenberg Air Force Base[d]	ocean	1/73	<0.01	0.01	<0.01	0.01	0.04	<0.001	<0.01	0.01	0.05
Federal Correctional Institution	land	12/70	0.01	0.00	0.000	0.01	0.00	<0.001			0.02
Santa Barbara Coastal											
Goleta[e]	ocean	11/72	0.005	0.017	0.15	0.86	0.27	0.001	0.44	0.078	1.86
Santa Barbara	ocean	12/70	0.01	0.005	0.000[g]	0.06	0.02	0.003			0.22
		12/70	0.004	0.0	0.21[g]	0.04	0.0	0.0			0.06
		6/72	<0.01	<0.01	<0.01	<0.01	0.10	<0.001			0.10
Montecito[f]	ocean	12/72	<0.001	<0.001	0.003	0.07	0.02	<0.001	<0.01	0.009	0.22
Summerland	ocean	12/70	0.00	0.00	0.000[g]	0.62	0.12	<0.001			0.22
		6/72	<0.01	<0.01	<0.01[g]	<0,01	0.04	<0.001			0.11
Carpinteria	ocean	12/70	0.00	0.00	0.000[g]	0.02	0.01	<0.001			0.05

[a]Analyses performed by California State Health Department unless otherwise noted.
[b]Concentration not to be exceeded 50% of the time.
Concentration not to be exceeded 10% of the time.
Sources:
[c]John Carrollo Engineers. Technical Report on Waste Discharge to the Ocean for Morro Bay-Cayucos Wastewater Treatment Plant. January, 1973 (average of 2 analyses).
[d]Department of the Air Force. Technical Report on Waste Discharge to Ocean Waters, Vandenberg Air Force Base, California. January, 1973.
[e]James M. Montgomery, Consulting Engineers, Inc. Goleta Sanitary District, Ocean Waters Waste Discharge, Technical Report. January, 1973.
[f]Brown and Caldwell. Montecito Sanitary District, Wastewater Ocean Disposal Technical Report. February, 1973.
[g]Hexavalent chromium.

by industrial recycling, by coordination of water use among local agencies, by conjunctive operation of surface storage and groundwater basins and by pricing policies which reflect economic value of water, should be carefully considered. Proposed future water supply projects have been discussed previously; in some cases they are briefly summarized below.

Imports

The Coastal Aqueduct of the California State Water Project may import a maximum of 82,700 acre-feet into the southern portion of the Central Coastal Basin and the United States Bureau of Reclamation's authorized San Felipe Division of the Central Valley Project may import a maximum of 106,300 acre-feet per year into the AMBAG area. Serious consideration should be given to an interim import of water from Lake Casitas in Ventura County to the Santa Barbara Coastal Sub-basin. Unused capacity in the West Branch of the California Aquaduct could be used to deliver water in Ventura County in lieu of water from Lake Casitas.

Wastewater Reclamation and Reuse

As discussed in Chapter 13, water balance considerations for some sub-basins clearly require new water source development or increased reliance on wastewater reclamation. Many inland areas can effect reclamation and reuse through land disposal techniques emphasizing groundwater recharge or substitution of wastewater effluents for local irrigation supplies. Coastal areas of Monterey Bay have potential for reclamation in agricultural areas of the lower Salinas and Pajaro Rivers. Coastal areas will find total reclamation more difficult, and it is anticipated that the more intensively urbanized areas, such as the Santa Barbara Coastal area, will be limited to seasonal irrigation reuse on such areas as golf courses, parks, and freeway medians. Where agricultural areas are sufficiently close to wastewater treatment facilities, arrangements could be made to substitute wastewater effluents for local irrigation supplies. This may require additional treatment and institutional arrangements to effect such reuse; the Goleta vicinity is one area which could pursue seasonal use of reclaimed wastewater as water is clearly becoming a scarce resource in this area.

Weather Modification

Cloud seeding operations within the Central Coastal Basin have been carried out in the past in Santa Clara, San Benito and Santa Barbara Counties, and increases in precipitation have been claimed. Southwestern Monterey County and the northwest portion of San Luis Obispo County have been covered by cloud seeding operations. The Monterey County Flood Control and Water Conservation District has not completed its evaluation but believes that cloud seeding can be effective in these areas. Evaluation of the effectiveness of cloud seeding, however, has been generally inconclusive. Seasonal weather patterns over the basin are such that cloud seeding operations cannot be considered a significant factor in providing additional water supplies.

Watershed Management

Because of ecological problems and costs associated with manipulation of watershed vegetative cover, watershed management is not considered a feasible means of providing any substantial additional water supplies within the Central Coastal Basin during the study period.

Groundwater Basin Management

Conjunctive operation of surface storage and groundwater basins within the Central Coastal Basin has been very successfully practiced within recent years. The major surface reservoirs in the basin are dedicated to storing winter runoff for release when conditions are favorable for percolation to the groundwater basins from the downstream natural stream channels. Additional reservoirs are planned within the basin partially for the purpose of groundwater recharge. Arroyo Seco Reservoir is an example of such a project proposed for the Salinas River Sub-basin.

When projects are constructed in the future for import of water to the Central Coastal Basin, consideration should be given to utilizing capacity not required for direct deliveries in the initial years of project operation to importing water for groundwater recharge. Conditions in the Santa Maria River Sub-basin may be particularly favorable for this type of operation.

Future distribution of surface water in the lower Salinas basin has been proposed which would permit more effective recharge of the East Side aquifer. Elsewhere in the planning area, future recharge activities are expected to increase. Salt routing projects may also be useful in containing highly mineralized surface waters during the dry season for wet weather release and dilution, particularly in the East side of the Salinas River where mineralized surface waters are known to degrade groundwater.

Effective groundwater management in the Monterey Bay area may in the future require injection wells along the bay to prevent intrusion of sea water. Surface delivery of irrigation water to the area fronting Monterey Bay is also being considered. This could reduce over drafts and aid in correcting sea water intrusion.

Development of Local Surface Runoff

In much of the Central Coastal Basin, substantial development of surface water has already occurred. Existing projects have been discussed previously. In the three sub-basins in the Santa Cruz area, Santa Cruz Coastal, San Lorenzo River and Aptos-Soquel Creek, substantial surface water development is planned to supply municipal water requirements. Additional surface water development for municipal supply may also be undertaken in the Carmel River Sub-basin. The Arroyo Seco Project has been discussed previously for recharge of Salinas River Sub-basin groundwaters. There is a substantial potential for future surface water development in the northern portion of the San Luis Obispo Coastal Sub-basin. However, it is unlikely that development will occur during the next 25 years since alternative sources of supply are less costly.

Desalination

The California Department of Water Resources and the Federal Office of Saline Water has proposed the construction of a 35,000 acre-feet per year capacity desalting plant in San Luis Obispo County in conjunction with Pacific Gas and Electric Company's Diablo Canyon Nuclear Power Plant. Congress has failed to provide the funding for Federal participation and the Department of Water Resources will not construct the project alone. Pacific Gas and Electric is proceeding with construction but the possibility of adding a desalination plant is not eliminated. The desalination portion is designed so it can be constructed after the power plant. Escalation of power cost, a lack of participation by the OSW, and recent technological advances with the reverse osmosis process of desalination, all indicate a lack of feasibility for a desalination plant in conjunction with the Diablo Canyon Nuclear Power Plant.

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Chapter 15 Problem Assessment

Water quality problems are assessed in this chapter in terms of the effectiveness of control actions in reducing waste loadings or otherwise upgrading water quality.

CRITERIA AND PROCEDURES

Water quality problems described in Chapter 14 are for the most part related to waste emissions from point and non-point sources, although in some cases water quantity and geologic limitations are primary causes. Waste loadings can be determined for point sources based on waste characteristics and the effect of various treatment processes or other controls. Similarly waste assimilative capacity of receiving waters can be determined for specific water quality factors; this procedure varies with pollutant characteristics and the nature of receiving waters. In the Central Coastal Basin few source discharges are to streams; most discharges are to ocean water or to land. Where land disposal is practiced groundwater quality is a special consideration in the waste assimilative capacity determination; unfortunately groundwater quality assessments are usually complicated by local geology and non-point effects such as agricultural drainage and natural and induced recharge.

The Federal Water Pollution Control Act Amendments of 1972 place emphasis on the limitation of pollutant discharge; although minimum effluent limits are generally prescribed (see Chapter 10), there is provision for stricter limits or controls. Section 302 (a) states: "Whenever, in the judgment of the Administrator, discharges of pollutants from a point source or group of point sources, with the applications of effluent limitations required under section 301 (b) (2) of this Act, would interfere with the attainment or maintenance of that water quality in a specific portion of the navigable waters which shall assure protection of public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water, effluent limitations (including alternative effluent control strategies) for such point source or sources shall be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality."

Accordingly it is necessary to review the water quality problems of the basin and determine where stricter limits or controls may be warranted. This procedure involves assessment of waste loads from point and non-point sources and a classification and ranking of waters.

Classification involves several determinations which include recognition of beneficial uses, discharge prohibitions, water quality objectives, existing water quality and effluent limits applicable to the waters in question. Where surface waters are involved the minimum effluent limits which may apply to municipal wastewaters under present federal guidelines are equivalent to secondary treatment. Industrial guidelines differ and more generally apply to best practicable treatment and to elimination or reduction of pollutant discharge.

Where water quality objectives for a surface water segment are not met by provision of the prescribed minimum effluent limits for point sources, a stricter control is envisioned wherein the assimilative capacity of receiving waters is determined and waste loads are allocated among point sources to effect compliance, if possible. These more complex situations, which are termed "water quality class", often involve non-point waste loads as well. The simpler case where compliance is achievable through implementation of the minimum effluent limits prescribed by EPA is termed effluent limited segments. Groundwaters are not currently covered by this provision of the 1972 Federal Act Amendments; however, the same procedures can be used in concept although the technical approach to waste load allocation would differ. Groundwater quality objectives stress mineral parameters pertinent to water supply, whereas the surface water objectives also include parameters which are provided to protect aquatic life habitats and other in-place uses.

ASSESSMENT OF WASTE LOADS

Waste loadings have been developed as part of the planning effort following somewhat different assumptions for the AMBAG and Southern Central Coastal areas of the basin. This background material is included in abbreviated form in this report but can be reviewed in more detailed form in the December 1973 AMBAG Report, the October 1973 Unabridged Draft of the Central Coastal Basin, Southern Portion, and task reports on waste loads, all of which are available in the Regional Water Quality Control Board and State Water Resources Control Board files.

Both point and non-point waste loads were determined for present conditions and projected to reflect population and land use expected in 1980, and 2000. These loadings and the assumptions used in their computation are discussed in the following sections.

Point Source Waste Loads

A survey of existing municipal discharges was conducted as part of the AMBAG study and in the southern portion of the Central Coastal Basin as part of the basin planning effort. Estimates of industrial waste loads were made based on characteristics of the industries which provide separate or discrete treatment and disposal. Solid waste loadings were developed from unit factors developed by the Department of Health; vessel wastes were determined from data obtained from a study of wastes from naval vessels in the San Diego Bay conducted by the Federal Water Quality Administration in 1969; recreational waste loads were determined from information obtained on the Muir Woods National Monument in 1972 for the National Park Service by Brown and Caldwell.

AMBAG Area Waste Loads

Basic data on present rates of flow and qualities of municipal wastewaters were obtained from a survey of existing municipal wastewater dischargers in the AMBAG area. Additional data were obtained from the Central Coastal Regional Water Quality Control Board.

Domestic waste flows and constituent loadings were projected for each planning area to the year 2000. Different procedures were used to project waste loadings depending on the status of sewering in a planning area, seasonal variations in flow and characteristics of the contributing source.

Projections of average annual sewered domestic waste flows were made on the basis of forecasted increase in population. Existing flows and constitutent loadings for each planning area in this category were divided by the existing sewered population to determine per capita waste production factors. Present per capita waste production factors were then multiplied by the projected future sewered population to give projected average annual flow and constituent loading values.

For planning areas which have no existing sewerage facilities, projections of waste flow and constituent loadings were generally made using the per capita waste production factors of an adjacent sewered area. When there was no adjacent sewered area, a unit flow factor of 60 gallons per capita per day was used. Unit flow values calculated for Chualar County Sanitation District (38 gpcd) and the City of Gonzales (39 gpcd) appeared to be low. Therefore, based on engineering judgment, 60 gpcd was used for these two areas.

In several planning areas the summer population is much greater than the permanent population. These areas contain vacation homes and recreational facilities. Collection, treatment and disposal facilities for these areas should be capable of handling peak summer flows. For these areas average annual dry weather flows were determined by multiplying forecasted summer populations by per capita waste production factors. Summer populations (two times the permanent population was used) for these areas were generally forecasted in previous studies.

Projections of waste flows from parks were based on information contained in a report by the California State Department of Parks and Recreation. For each planning area, average annual dry weather flows were projected either on the basis of permanent or summer population, as discussed above and park flows were included if significant. Average annual dry weather flows were used to size treatment facilities. Peak instantaneous flows were used to size interceptors and pump stations. Peak instantaneous flow is comprised of peak dry weather flow plus infiltration. Estimates of infiltration were made for each existing sewerage system and future additional infiltration was assumed to be 110 gallons per capita per day times the additional future sewered population. Table 15-1 presents a summary of projected average municipal wastewater loadings in the AMBAG area; more detailed data are included in the AMBAG report.

Although the Montery Bay Regional Planning Area is not heavily industrialized, significant industrial activity does take place. For the AMBAG study, industrial waste discharges were classified as either discrete or nondiscrete. Nondiscrete industrial waste discharges enter municipal or other public sewerage systems and are treated in the same treatment plants as domestic wastewater. The waste loads from these discharges were included in the determination of present and forecasts of future domestic waste loads.

Food processing flows are taken by municipal treatment facilities at Castroville, Watsonville, Gilroy, Salinas, King City and Santa Cruz. Although the flows from food processing plants can generally be treated in combination with domestic wastes, it may be uneconomic to provide the required capacity for short seasonal use. Separate estimates were made of food processing flows; these are included in Table 15-2. Projections of waste flows were made by multiplying existing flows in each of six food processing areas by the ratio of projected to existing agricultural acreage serviced by the food processing area. The six processing areas are located in Gilroy, Hollister, Watsonville, Salinas, King City-Greenfield and Castroville.

Discrete industrial waste discharges are defined as those not intercepted by municipal sewerage systems. The present industrial waste loads other than non-discrete food processing loads are given in Table 15-3.

Municipal solid waste production is basically a function of the population of an area. Projections of municipal solid waste production for Santa Cruz and Santa Clara counties were made by multiplying the population forecasts for these counties by per capita waste production factors. It was assumed that the waste generating character of the populations of Monterey, San Benito and San Luis Obispo Counties is similar to that of Santa Cruz County. A summary of municipal solid waste production and projected production within the AMBAG study area is shown in Table 15-4.

The volume and composition of industrial solid waste is primarily a function of the type and size of the industry. However, since most of the industries located within the AMBAG study are light in character, industrial solid waste projections were made by multiplying present industrial waste loads by the ratio of forecasted population to present population. Table 15-5 shows projected industrial solid waste loads by county.

Food processing wastes are principally a function of the amount of raw materials processed. Projections of food processing solid waste loads were made by multiplying present solid waste loads by the ratio of present liquid waste flows to projected liquid waste from food processing flows. Food processing solid waste projections are summarized in Table 15-6.

For Santa Clara, San Benito, Monterey and San Luis Obispo Counties, crop residue production was estimated by multiplying the projected acreage of various types of crops by per acre waste production factors. Records of agricultural activity have produced sufficient data from which reasonable estimates of manure production per animal and residue production per acre from fruit and nut or field and row crops can be made. Agricultural solid waste projections by county are summarized in Table 15-7.

Vessel waste loadings in the AMBAG area result from commercial and recreational use of water craft on inland and ocean waters. However, it was assumed that wastes generated by vessel use on inland waters were included in the estimates of the recreational waste category. It was also assumed that wastes generated by commercial vessel use, with the exception of sanitary wastes, were included in the industrial waste loads category of wastes generated by the fishing industry. The foregoing assumptions limit the waste loads of concern in this section to sanitary wastes generated aboard ocean going commercial and recreational water craft. Because of the extremely diffuse nature of vessel waste discharges, the vessel waste loads generated in the study area were determined on a county level.

A study of the FWPCA of the characteristics of sanitary waste generated aboard naval vessels in the San Diego area produced data on pollutant constituent concentrations assumed to be representative of the vessel wastes generated in the Monterey Bay Regional Planning Area. Data gathered during the preparation of the California Small Craft Harbors and Facilities Plan were used to estimate present and future vessel use in the study area. That study found that ocean boating represented about 15 percent of the total amount of boat usage for all forms of recreational boating. It also found that boating ownership increased as average annual income increased and decreased as population density increased. Based on the above factors in the study, it was estimated that the number of small craft per 1000 persons in the Central Coastal Region would be about 30 in 1975. A survey of ocean vessel users indicated that boats spent an average of 16 days per year on ocean waters and carried four people on the average.

Based on the above averages and data on existing numbers of small craft per 1000 persons obtained from the California Department of Motor Vehicles, estimates of vessel ownership and use on ocean waters were made. These estimates and the data on wastewater characteristics discussed

Table 15-1. Waste Loading from Municipal Dischargers[a]

Sub-basin/discharger	Year	Flow rate, mgd	Waste loading, lbs/day			
			BOD	Suspended solids	Nitrogen	Phosphorus
Santa Cruz						
Ben Lomond[b]	1970	0.007	18	22	3	1
Big Basin State Park	1970	0.075	33	63	54	1
	1980	0.169	74	142	122	1
	2000	0.237	104	199	171	2
Davenport	1970	0.020	17	17	4	1
	1980	0.054	45	45	11	3
	2000	0.101	84	84	21	5
San Lorenzo Valley						
Boulder Creek			NO DATA			
Big Basin Woods[c]	1970	0.005	8	13	2	0
San Lorenzo Valley[c]	1970	0.010	17	22	4	1
Santa Cruz	1970	6.264	12,200	22,800	730	730
	1980	13.516	24,680	35,535	3,091	1,211
	2000	21.012	38,300	55,145	4,762	1,877
Scotts Valley[c]	1970	0.035	61	29	7	5
Rolling Woods[c]	1970	0.007	12	9	3	5
Aptos-Soquel						
East Cliff[c]	1970	3.500	5,840	5,015	1,460	175
Aptos[c]	1970	0.726	1,210	910	160	60
Sand Dollar	1970	–	96	116	28	6
Monterey Bay Academy[c]	1970	0.064	150	180	26	5
Pajaro River						
Watsonville	1970	6.300	11,700	11,700	2,630	530
	1980	10.600	18,800	19,000	4,430	890
	2000	17.700	31,100	31,700	7,400	1,470
Gilroy-Morgan Hill	1970	1.810	3,260	3,020	262	13
	1980	8.246	13,351	12,748	1,203	94
	2000	17.734	30,955	29,704	2,840	235
San Juan Bautista[c]	1970	0.113	190	265	12	3
Hollister	1970	0.468	1,535	1,140	470	63
	1980	0.750	2,250	1,874	636	86
	2000	1.206	3,730	2,995	1,061	145
Hollister Airport[c]	1970	0.008	13	20	3	2
San Benito County Hospital	1970	0.050	95	83	21	4
Tres Pinos CWD	1970	0.054	100	87	22	4
	1980	0.123	230	200	50	9
	2000	0.404	750	650	165	31
Salinas River						
Castroville[c]	1970	0.225	375	375	94	19
Oak Hills[c]	1970	0.030	50	75	12	2
Marina[c]	1970	0.482	980	1,210	101	56
Fort Ord[c]	1970	2.880	6,700	8,690	1,200	240
Salinas Main[c]	1970	5.170	10,100	13,000	2,160	194

Table 15-1. Waste Loading from Municipal Dischargers[a] (continued)

Sub-basin/discharger	Year	Flow rate, mgd	Waste loading, lbs/day			
			BOD	Suspended solids	Nitrogen	Phosphorus
Salinas River (continued)						
Toro Park[c]	1970	0.117	98	98	49	8
Seaside CSD[c]	1970	1.580	3,620	3,050	1,782	270
Soledad	1970	0.280	467	467	104	36
	1980	0.418	696	696	155	53
	2000	0.703	1,172	1,172	261	89
Monterey-Salinas Region	1980	19.810	41,056	50,133	8,534	1,598
	2000	27.830	56,731	69,131	11,944	2,702
Salinas-Alisal[c]	1970	1.140	2,350	2,550	475	88
Chualar CSD	1970	0.018	40	45	13	2
	1980	0.078	110	123	37	7
	2000	0.120	170	189	57	10
Gonzales	1970	0.100	309	250	44	21
	1980	0.201	372	301	53	25
	2000	0.273	504	408	72	34
Soledad Prison	1970	0.520	967	801	203	35
	1980	0.627	1,165	965	245	42
	2000	0.731	1,359	1,126	285	49
Greenfield	1970	0.162	313	376	75	1,028
	1980	0.276	533	640	128	1,752
	2000	0.462	893	1,073	214	2,935
King City	1970	0.575	815	722	146	67
	1980	0.697	1,030	913	185	85
	2000	0.971	1,513	1,340	271	124
San Antonio Reservoir – North	1970	0.022	40	40	23	1
	1980	0.029	53	53	30	1
	2000	0.083	151	151	87	4
San Antonio Reservoir – South	1970	0.058	105	105	0	5
	1980	0.076	138	138	0	7
	2000	0.083	150	150	0	7
Camp Roberts[b]	1970	1.000	2,240	2,700	415	83
Paso Robles	1970	0.905	1,460	2,260	383	72
	1980	1.141	1,953	2,851	446	95
	2000	1.530	2,585	3,821	609	126
San Miguel[c]	1970	0.060	170	150	1	8
Atascadero	1970	0.468	324	500	7	19
	1980	1.545	1,719	2,613	56	98
	2000	2.527	2,969	4,524	91	170
Santa Margarita Elementary School[c]	1970	0.002	5	6	0	0
Hunter Liggett	1970	0.063	147	179	26	5
	1980	0.153	140	170	25	5
	2000	0.153	140	170	25	5
Oak Shores	1970	0.034	80	97	14	3
	1980	0.039	91	110	16	3
	2000	0.059	140	170	25	5
Heritage Ranch East	1980	0.145	340	410	61	12
	2000	0.278	650	790	116	23
Heritage Ranch Central	1980	0.528	1,260	1,530	220	44
	2000	1.016	2,360	2,860	425	85

Table 15-1. Waste Loading from Municipal Dischargers[a] (continued)

Sub-basin/discharger	Year	Flow rate, mgd	Waste loading, lbs/day			
			BOD	Suspended solids	Nitrogen	Phosphorus
Carmel River						
Monterey[c]	1970	2.610	6,640	8,430	1,070	234
Hidden Hills[c]	1970	0.014	33	40	0	0
Pacific Grove[c]	1970	1.300	1.990	2,200	188	179
Carmel SD	1970	0.961	2,114	1,566	311	48
	1980	0.999	2,197	1,627	323	50
	2000	1.263	2,779	2,058	409	63
Mid-Carmel Valley	1980	0.288	500	610	120	24
	2000	0.429	1,000	1,220	179	36
Upper Carmel Valley	1980	0.331	770	940	138	28
	2000	0.551	1,300	1,580	230	46
Monterey Coastal						
Carmel Highlands[c]	1970		NO DATA			
USN-Point Sur	1970	0.012	20	30	6	2
	1980	0.017	28	42	8	2
	2000	0.017	28	42	8	2
Pfeiffer-Big Sur State Park	1970	0.108	103	155	21	5
	1980	0.141	134	202	27	6
	2000	0.225	215	323	44	10

[a] Based on AMBAG study information.

[b] Projected dalues for 1980 and 2000 same as 1970.

[c] Projection not supplied for 1980 or 2000.

Table 15-3. Waste Loading from Independently Treated Industries, AMBAG Area[a]

Area[b]	Peak flow, mgd	Waste loadings, lbs/day				
		BOD_5	Suspended solids	Nitrogen	Phosphorus	Total dissolved solids
Castroville	0.020	800	337	14.9	5.3	217
Salinas South	0.033	15.6	12.5	73.5	8.9	701
Salinas	0.120	6.0	3.0	3.0	0.3	120
Carmel Valley	0.125	1.7	459	0.6	0.6	417
Gonzales	8.200	206,700	428,100	68,170	7,658	196,250
King City	0.200	20,900	1,670	1,160	618	7,720

[a] Based on Table 5-10 of the AMBAG Water Quality Management Plan, December, 1973 (Final Report); values applicable for 1970-2000 per AMBAG Report.

[b] Areas as designated in AMBAG study.

Table 15-2. **Waste Loading from Collected Food Processing Industries, AMBAG Area**

Area	Year	Flow rate, mgd	Waste loadings, lbs/day				
			BOD	Suspended solids	Nitrogen	Phosphorus	Total dissolved solids
Pajaro	1970	0.030	500.0	200.0	7.2	1.1	250.0
	1980	0.033	550.0	222.0	7.9	1.2	275.0
	2000	0.037	616.7	246.7	8.9	1.4	308.3
Watsonville	1970	5.740	14,900.0	34,000.0	4,780.0	720.0	47,870.0
	1980	6.240	16,197.9	36,961.7	5,196.4	782.7	52,039.9
	2000	7.023	18,230.4	41,599.7	5,848.4	880.9	58,569.9
San Martin	1970	0.316	2,110.0	527.0	39.5	5.3	132.0
	1980	0.335	2,236.9	558.7	41.9	5.6	139.9
	2000	0.354	2,363.7	590.4	44.2	5.9	147.9
Gilroy	1970	2.830	23,600.0	11,800.0	7,080.0	165.0	70,800.0
	1980	2.997	24,992.6	12,496.3	7,497.8	174.7	74,978.0
	2000	3.172	26,452.0	13,226.0	7,935.6	184.9	79,356.0
Hollister	1970	5.000	40,000.0	28,900.0	19,500.0	419.0	125,000.0
	1980	5.295	42,360.0	30,605.1	20,650.5	441.6	132,375.0
	2000	5.604	44,832.0	32,391.1	21,855.6	467.4	140,100.0
Castroville SD	1970	0.128	750.0	750.0	110.0	20.0	1,070.0
	1980	0.128	750.0	750.0	110.0	20.0	1,070.0
	2000	0.128	750.0	750.0	110.0	20.0	1,070.0
Salinas South	1970	3.400	7,940.0	6,030.0	6,080.0	810.0	37,200.0
	1980	3.784	8,836.8	6,711.0	6,766.7	901.5	41,401.4
	2000	4.190	9,784.9	7,431.1	7,492.7	998.2	45,843.5
King City	1970	1.200	7,500.0	7,500.0	1,000.0	150.0	10,000.0
	1980	1.336	8,350.0	8,350.0	1,113.3	167.0	11,133.3
	2000	1.479	9,243.7	9,243.7	1,232.5	184.9	12,325.0

Table 15-4. **Present and Projected Municipal Solid Waste Production, AMBAG Area**

County	Municipal Solid waste production, 1,000 tons/year						
	1970	1975	1980	1985	1990	1995	2000
Santa Cruz	125	145	175	210	240	280	325
Santa Clara	35	60	115	160	210	240	275
San Benito	20	20	25	30	35	40	45
Monterey	250	285	335	390	435	490	550
San Luis Obispo	25	30	35	40	45	50	60
Total AMBAG area	455	540	685	830	965	1,100	1,255

Table 15-5. Present and Projected Industrial Solid Waste Production, AMBAG Area[a]

County	Industrial solid waste production, 1,000 tons/year						
	1970	1975	1980	1985	1990	1995	2000
Santa Cruz	5	5	5	10	10	10	10
Santa Clara	5	5	10	15	20	20	20
San Benito	<1	<1	<1	<1	<1	<1	<1
Monterey	10	10	10	15	15	15	20
San Luis Obispo	<1	<1	<1	<1	<1	<1	<1
Total AMBAG area	20	20	25	40	45	45	50

[a] Projections based on State Department of Public Health data.

Table 15-6. Present and Projected Food Processing Solid Waste Production, AMBAG Area[a]

County	Food processing solid waste production, 1,000 tons/year						
	1970	1975	1980	1985	1990	1995	2000
Santa Cruz	55	60	60	60	65	65	65
Santa Clara	5	10	15	25	30	35	35
San Benito	5	5	5	5	5	5	5
Monterey	65	70	70	75	80	80	80
San Luis Obispo	0	0	0	0	0	0	0
Total AMBAG area	130	145	150	165	180	185	185

[a] Projections based on State Department of Public Health data.

Table 15-7. Present and Projected Agricultural Solid Waste Production, AMBAG Area

County	Agricultural solid waste production, 1,000 tons/year						
	1970	1975	1980	1985	1990	1995	2000
Santa Cruz	100	100	100	100	95	95	95
Santa Clara	180	165	155	140	140	130	130
San Benito	180	200	220	245	270	275	280
Monterey	780	830	880	930	980	1,010	1,030
San Luis Obispo	25	25	30	30	30	30	30
Total AMBAG area	1,275	1,320	1,385	1,445	1,515	1,540	1,565

Table 15-8. Present and Future Average Annual Vessel Waste Loads, AMBAG Area

County	Year	Wastewater volume, mg/year	Mass emission rate, lbs/year			
			BOD_5	Settleable solids	TN-N	TP-P
Santa Cruz	1970	1.4	1,000	790	620	65
	1980	1.7	1,200	960	750	80
	1990	2.2	1,600	1,250	970	105
	2000	2.7	2,000	1,550	1,200	125
Monterey	1970	2.7	2,000	1,550	1,200	125
	1980	3.3	2,350	1,850	1,450	155
	1990	4.0	2,900	2,250	1,750	185
	2000	4.7	3,400	2,650	2,100	220

Table 15-9. Average Annual Recreational Waste Loads, AMBAG Area

Sub-basin	Year	Average annual volume, million gallons	Mass emission rate, 1,000 lbs/year				
			BOD_5	SS	TN-N	TP-P	Oil and grease
Santa Cruz Coastal	1970	13.1	19.5	19.5	15.2	1.1	2.4
	1980	16.0	24.0	24.0	18.7	1.4	2.9
	2000	24.5	36.5	36.5	28.5	2.1	4.5
San Lorenzo River	1970	16.1	24.0	24.0	19.0	1.4	2.9
	1980	25.0	37.5	37.5	29.5	2.1	4.6
	2000	44.0	66.0	66.0	52.0	3.8	8.1
Aptos-Soquel	1970	14.0	21.0	21.0	16.5	1.2	2.6
	1980	19.5	29.0	29.0	22.0	1.7	3.6
	2000	30.0	45.0	45.0	35.0	2.6	5.5
Pajaro River	1970	9.0	13.5	13.5	10.5	0.8	1.7
	1980	12.0	18.0	18.0	14.0	1.0	2.2
	2000	18.5	27.5	27.5	21.5	1.6	3.4
Salinas River	1970	24.0	36.0	36.0	28.0	2.1	4.4
	1980	32.0	48.0	48.0	37.0	2.7	5.9
	2000	49.0	73.0	73.0	57.0	4.2	9.0
Carmel River	1970	8.0	12.0	12.0	9.5	0.7	1.5
	1980	11.0	16.5	16.5	13.0	0.9	2.0
	2000	16.5	25.0	25.0	19.5	1.4	3.0
Monterey Coastal	1970	17.0	25.5	25.5	20.0	1.4	3.1
	1980	28.0	42.0	42.0	33.0	2.4	5.2
	2000	50.0	75.0	75.0	59.0	4.3	9.2

earlier were used to estimate the average annual vessel waste loads given in Table 15-8.

Data on the average annual volume of wastewater produced by the users of the public and private recreation areas of more than ten acres in the Monterey Bay Regional Planning area were provided by the Department of Parks and Recreation. A study of the characteristics of recreational wastewater at the Muir Woods National Monument in Marin County, California, found that overall recreational wastewater is similar to municipal wastewater with the exception of nitrogen and phosphorus concentrations. Recreational wastewater is high in nitrogen and relatively low in phosphorus due to the high amount or urine and the low amount of laundry wastes. Wastewater quality data measured in the above study were assumed to also represent the quality of recreational wastewaters generated in the Monterey Bay Regional Planning Area. The average annual volume of recreational wastewater estimated by the Department of Parks and Recreation and the assumed wastewater quality were used to calculate the average annual recreational waste loads given in Table 15-9.

Southern Area Waste Loads. In general per capita wastewater flows are increasing throughout the southern portion of the Central Coastal Basin. The magnitude of increase in per capita flow rate over the 30-year design period of this study depends on speculative factors such as relative cost of water, changes in living habits, popularity of apartment dwelling, and the general economic level of the community. In the near future, increases in unit volumes will undoubtedly occur because of the known trend toward increased household use of water. For example, labor-saving appliances such as automatic clothes washers and dishwaters require considerably greater volumes of water than did former equipment or methods. Food waste disposers (garbage grinders) cause an additional, but minor, increase in per capita flows, on the order of one to two gcd, as determined in studies by appliance manufacturers and the Los Angeles County Sanitation District. Use of all automatic home appliances is increasing, and provisions are made for them in most new homes and apartment buildings.

At the same time however there is evidence that these high rates of increase are not likely to continue. Apparently, the major effect of rapid urban growth, accompanied by large volume installation of automatic appliances is a transient phenomenon, and further per capita flow increases after an area becomes "urbanized" will be more gradual. Some communities in the southern Central Coastal Basin however have not yet been affected by contemporary urban development and have relatively low per capita flow rates at the present time. It is anticipated that when growth does occur in these areas they too will exhibit relatively rapid sewage flow increases and then will tend to level off and increase only gradually thereafter.

Interestingly, more efficient appliances and plumbing devices are available which, if put to widespread use, could substantially reduce household water usage. Bathing and toilet flushing account for as much as 65 to 75 percent of total household use and a recent study for the Environmental Protection Agency concludes that "water for bathing, toilet flushing and laundry could be economically reduced approximately 35 percent by use of presently available devices and technology. In a city of 100,000 these savings could amount to more than two million gallons of water per day that would not have to be supplied to the users and eventually treated in the treatment plant." An example of such a water saving device is the British dual cycle water closet which uses a 2.5 gallon flush for solids and 1.25 gallons for urine. These figures can be compared to present American toilets which require 5 to 6 gallons for each use. It was estimated that a water use reduction of 17.5 gcd could be made from present levels by the installation of dual cycle toilets, and an additional 6 gcd by the use of limiting flow valves for showers. In addition to the British device, it is also known that the average flush tank volume in Sweden is less than three gallons. In this country low-contour toilet designs with small flush tanks are now being installed in many new homes. As urban water supply and wastewater disposal become relatively more expensive, such plumbing facilities are expected to become more popular.

In the development of general unit wastewater volume design factors two assumptions are made. First, because of the character and extent of present and anticipated future industrial and commercial wastewater contributions to sewers, it is assumed that industrial and commercial wastes can be included in the per capita flow figures. The diffuse nature and "services" orientation of the industrial and much of the commercial development makes this a reasonable assumption. Second, it is assumed that the wastewater contribution of the tourist trade will be directly related to the resident populations of those communities for which the tourism is significant. Thus the contribution of tourists and their activities will also be included in the per capita flows for tourism-oriented communities such as San Simeon and Morro Bay. The tourist contribution was determined by comparing the per capita flows during dry weather periods for both summer (tourist) season and for the winter season. Per capita flows were determined using an estimate of the resident population.

In addition to the "intangible" factors discussed earlier concerning the trends in wastewater volumes, other data from community, county and regional planning agencies were also assessed. Particular attention was given to local land use planning as it involved anticipated changes in the areas dedicated to commercial and/or industrial use. Such data were analyzed to assess the impact of planned industrial and/or commercial development on future per capita flows.

Consideration of the above factors led to the selection of the design unit flow curves shown in Figure 15-1. One of the unit design flow curves was assigned to each of the developed areas in the southern portion of the Central Coastal Basin. It should be understood that these curves are not intended to be hard and fast predictions of what per capita flows will be in the future. They are shown as a range and are intended to serve as indicators of current trends that will enable a reasonable estimate of future flows.

In those communities where residential development is expected to predominate, curve A is applied. Communities of this type have low per capita flows now which are expected to increase to about 90 gcd by the year 2000. Commercial and/or industrial acreage is expected to account for less than 0.5 acre per 100 persons when these communities are ultimately developed. In areas where light commercial and/or industrial development is expected to occur, curve B is applied. It is anticipated that in communities of this type more than 0.5 but less than 1.0 acre of commercial and/or industrial area per 100 persons will exist at ultimate development. Similarly curve C is applied to those communities that have planned for medium commercial and/or industrial development to occur ultimately. Medium commercial and industrial development has been defined as more than 1.0 acre per 100 persons.

For those areas where special circumstances such as significant tourism or homeowner affluence will predominate, individual unit design flow curves have been developed.

Unit wastewater flow, in terms of gallons per capita per day, was used as the basis for calculating projected average dry weather wastewater flows (ADWF). Projections were made by assuming that, for example, the human population and their activities in "A" curve-type communities will generate about 88 gcd in the year 1990.

Ratios of the total municipal Peak Dry Weather Wastewater Flows (PDWF) to ADWF presently range from 1.2 to 3.4, based on peak hourly flows. From past experience it is anticipated that these ratios will tend toward a value of 1.5 for systems not affected by dry weather infiltration as the individual sewerage areas grow in population. The peak to average dry weather flow ratio tends to decrease as population increases. Applicable ratios for systems not affected by dry weather infiltration are shown in Figure 15-2 and are applied, according to population, in projections.

Dry weather infiltration can substantially decrease the peak to average dry weather flow ratio. This can happen in inland areas where sewers are installed below the groundwater table or where percolating irrigation waters can enter municipal sewers. Dry weather infiltration can also occur when sewers in coastal communities are constructed near or below sea level. Sea water then may infiltrate into the system, possibly only during high tides. If dry weather infiltration rates exceed a value consistent with modern sewer design and construction practices, remedial action should be taken before the capacity of existing interceptor sewers and wastewater treatment plants is increased.

Storm water inflow, the combined effects of wet weather infiltration and direct storm inflow, must be added to the peak dry weather flow (PDWF) to establish the peak wet weather flow (PWWF). This parameter determines the maximum hydraulic capacity of pipelines and various treatment plant units.

Infiltration of storm water and inflow of storm water occurs in any sewer collection system. Because of this all collection systems are designed to include capacity for extraneous flows. Quantitative values used in initial designs have been arrived at from field data collected by many authorities. Two basic approaches are used, one which relates infiltration to the area served by the collection system and the other which relates infiltration to the length and diameter of the sewers in the collection system. All these values for infiltration assume that both good materials and construction techniques were employed in the initial installation of the sewers. The area method is more appropriately applied to local collection system than transfer trunk sewers, whereas the length-diameter method can be applied to transfer trunk sewers. Accepted ranges of values for infiltration for design are shown in Table 15-10.

In the study area the increase in wet weather flow over dry weather is observed by referring to past records. Capacity for stormwater inflow and infiltration must be provided in wastewater facilities to comply with federal and state requirements to prevent hazards to public health. The Environmental Protection Agnecy (EPA) guidelines for design, operation, and maintenance of wastewater treatment facilities prohibit treatment plant bypasses. Systems therefore must be designed to accommodate a nominal rate of stormwater inflow consistent with modern sewer design and construction practices.

Infiltration into the present wastewater systems was estimated by observing the daily variation in the rate of wastewater flow recorded at the treatment plants in the study area where such information was available. As an example the daily minimum rates of flow at the Lompoc wastewater treatment plant during the period November 3 through 9, 1971 after a prolonged dry period are essentially equal to those during the wet weather period of December 22 through 28, 1971, as shown on Figure 15-3. These minimum rates indicate little or no difference and therefore exhibit essentially no measureable infiltration of stormwaters.

For the City of San Luis Obispo, on the other hand, the daily minimum rates of flow at the San Luis Obispo Wastewater treatment plant during the period December 22 through 28, 1971 after a prolonged wet period are about 1.7 mgd higher than those during the dry weather period mentioned above. The excess flow represents about 515 gallons per acre per day (gad) of stormwater infiltration. Rates of stormwater infiltration were also investigated during wet weather periods for the other service areas in the southern Central Coastal Basin for which continuous flow record data were available. Available data indicate that extreme flows measured during wet weather are almost entirely due to storm inflow and that infiltration is a minor consideration in most of the present systems. Therefore, for the purposes of planning, a relatively low infiltration rate of 250 gallons per acre per day will be used for most of the collection systems. Exceptions to the use of this value are indicated in Table 15-11 presenting peak wet weather flows for the southern area.

As was mentioned earlier direct storm inflow also normally contributes to extreme flows measured during wet weather. The rates of flow at the Lompoc and San Luis Obispo wastewater treatment plants have been shown on Figures 15-3 and 15-4 to illustrate the method by which the magnitude of direct storm inflow was determined in this study. In general the rate of storm inflow on a rainy day is represented by the difference between the rate at a given time on that day and the rate on comparable dry days. For example, a peak of 3000 gpm was recorded at 2:00 am on December 27 at the Lompoc plant, while the rate averaged 810 gpm at the same time during the period November 3 through 9 when there had been no rainfall. The excess is for the most part attributable to storm inflow. With approximately 3600 acres tributary to the plant, the rate of inflow in this case was equivalent to 875 gad. The total amount of rainfall on December 26-27, 1971 was measured in Lompoc to be 2.7 inches.

By contrast a peak of about 10.6 mgd was recorded at 1:00 am on December 27 at the San Luis Obispo plant, while the rate averaged 2.4 mgd at the same time during the period August 4 through 10 when there had been no rainfall. The excess, 8.2 mgd, or about 2,500 gad, is for the most part attributable to storm inflow. Rates of direct stormwater infiltration were also investigated for the other service areas in the study area. The combined values of infiltration and direct inflow that could be obtained are presented in Table 15-11. Based on these determinations and experience in other similar areas, a unit direct stormwater inflow rate of 750 gad will be used in this study unless special circumstances warrant a higher value.

Wastewater systems may be expected to have an economic life of 50-100 years or more. During this period it can be anticipated that the water tightness of sewers will progressively deteriorate from the combined effects of settlement, root penetration, faulty service connections and the like. However, because most modern sewers are sound and watertight when constructed, it is reasonable to assume that deterioration will be gradual. For these reasons a value of 1,000 gad

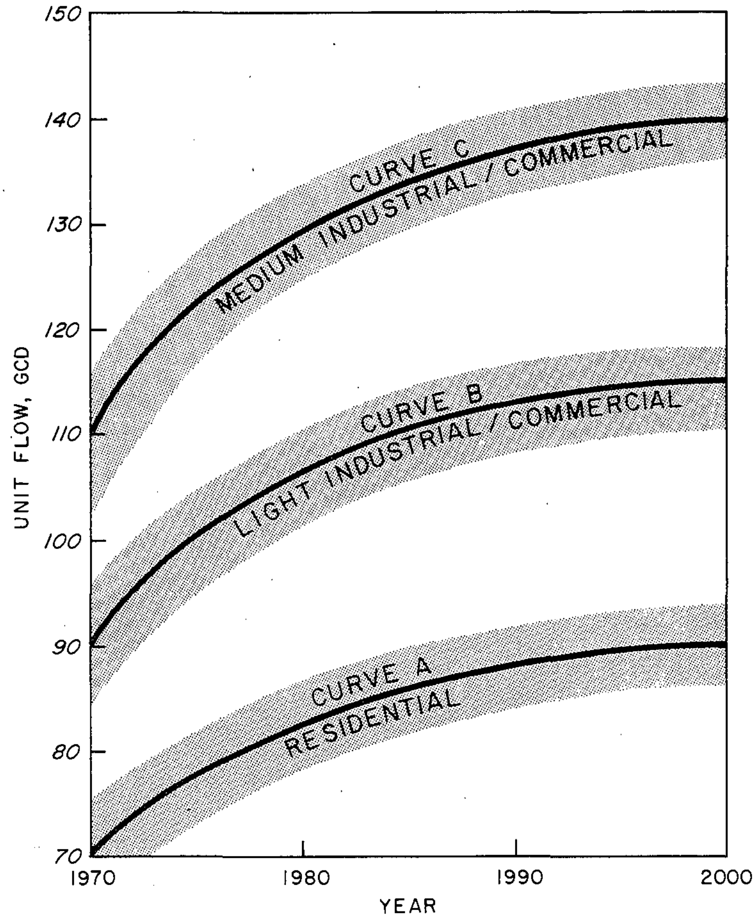


Fig. 15-1. Design Unit Flow Curves

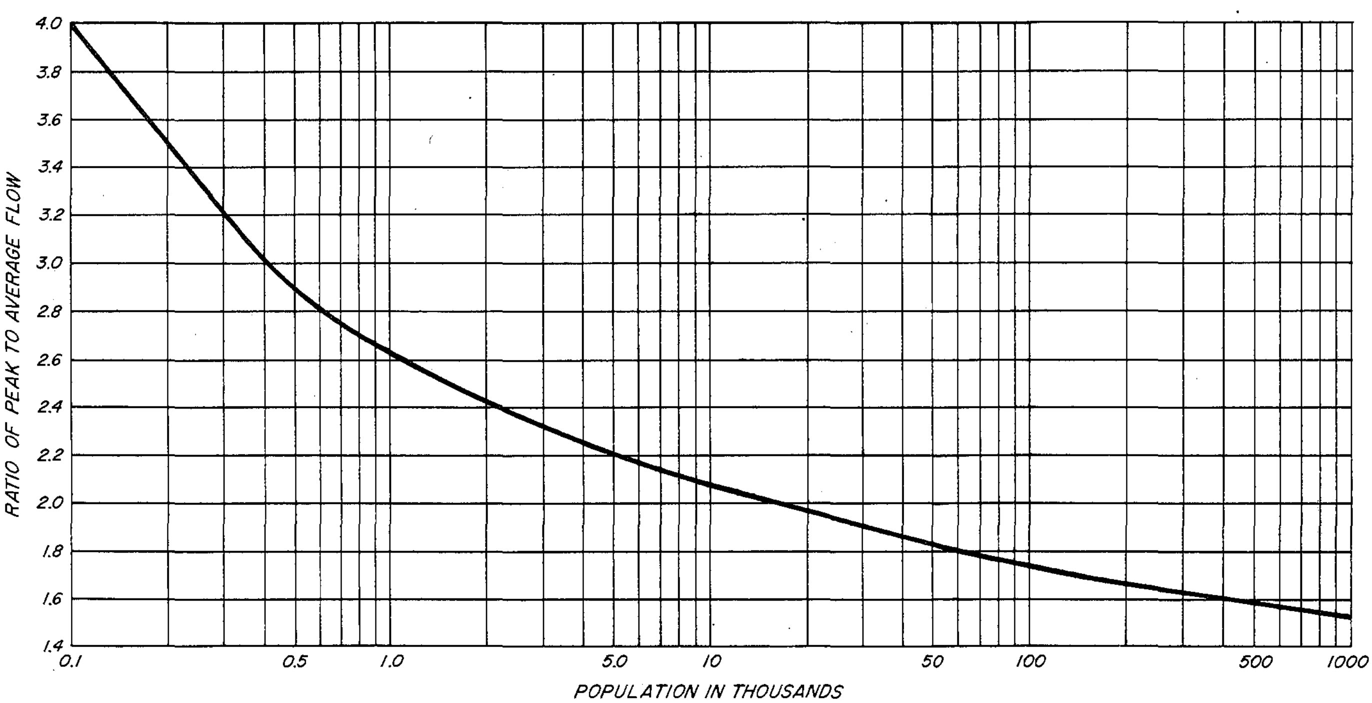


Fig. 15-2 Peak to Average Dry Weather Flow Ratio

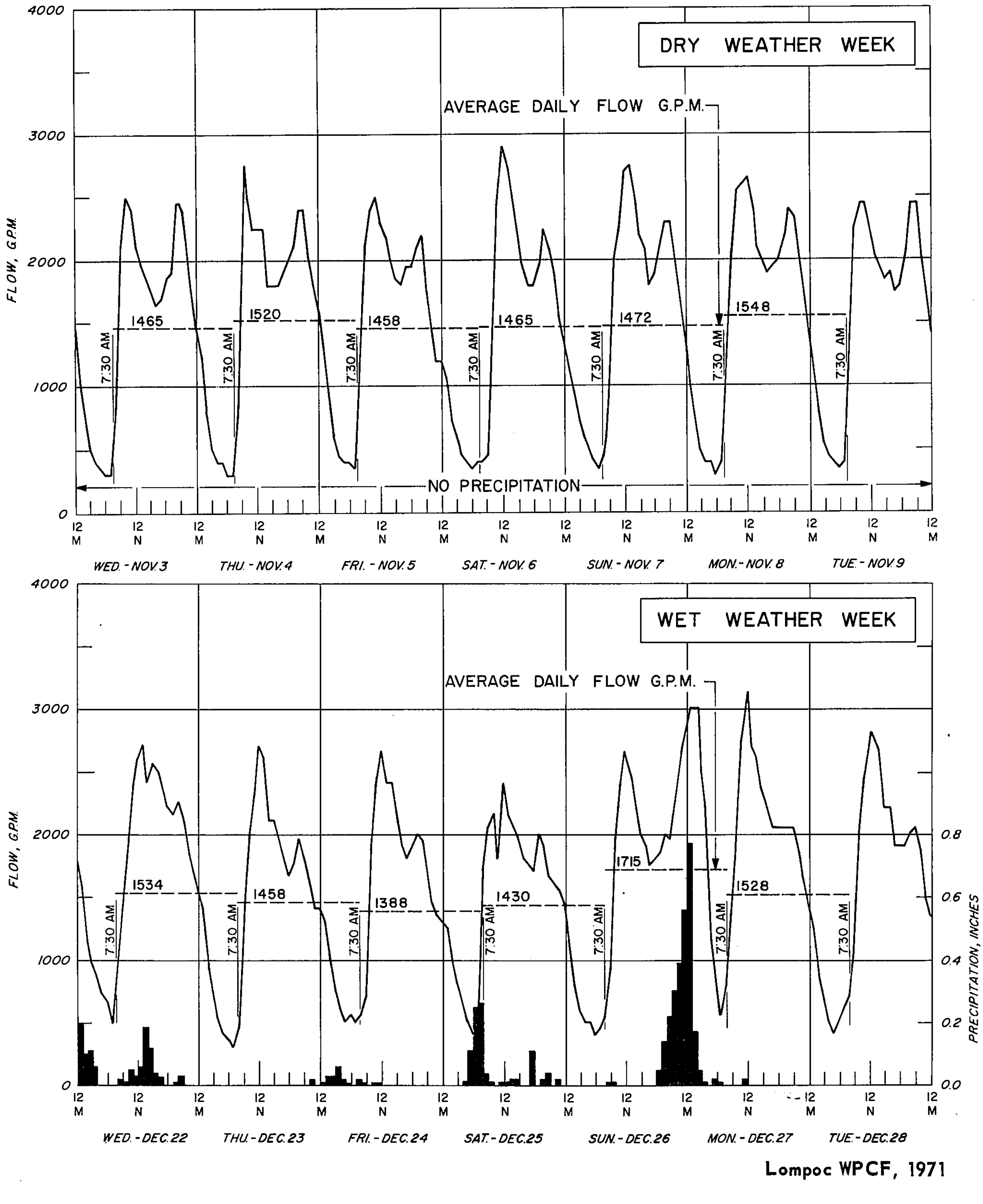


Fig. 15-3 Comparison of Wet Weather and Dry Weather Flows at the Lompoc Treatment Facility

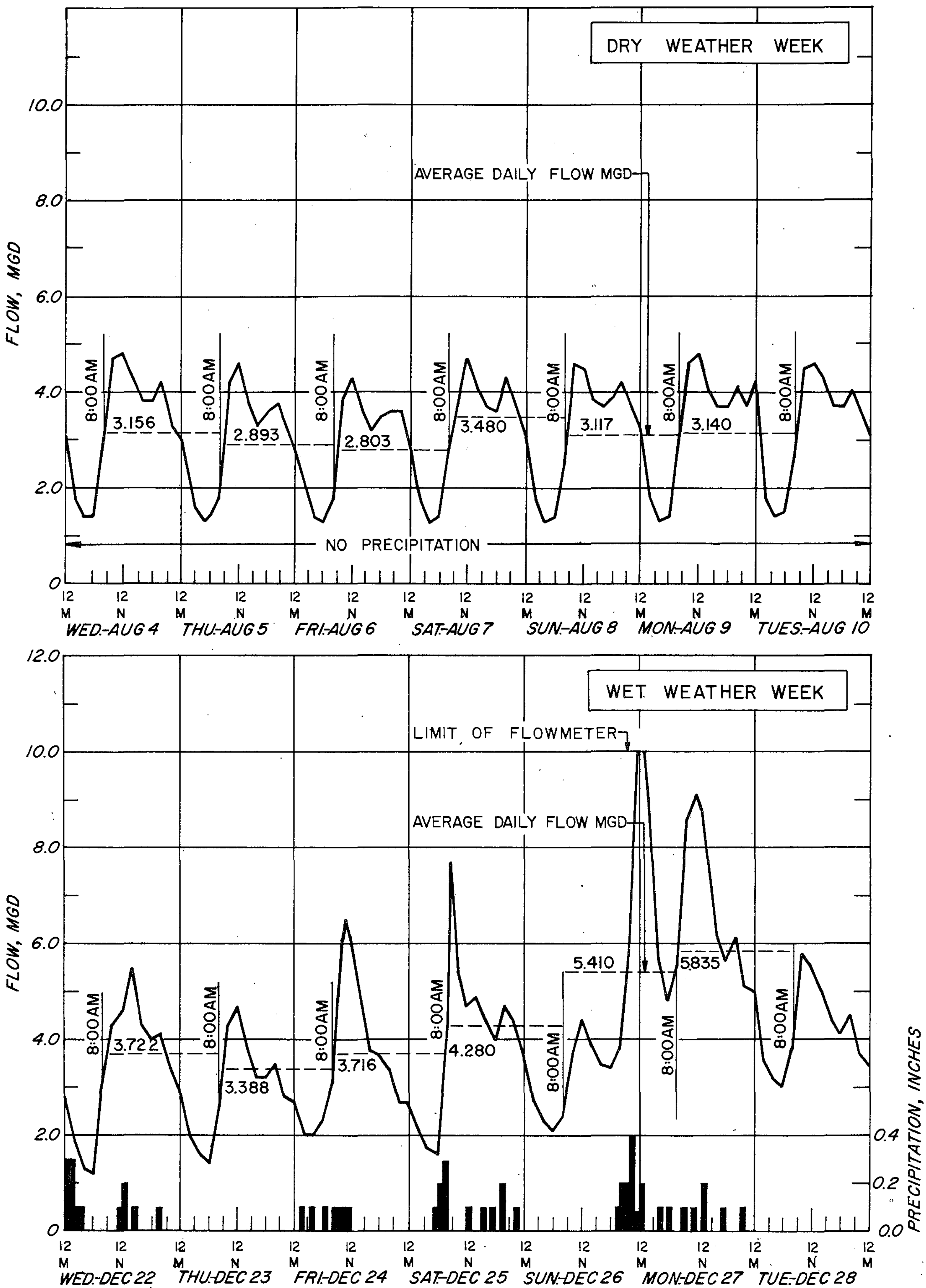


Fig. 15-4 Comparison of Wet Weather and Dry Weather Flows at the San Luis Obispo Treatment Facility

Table 15-10. **Infiltration Specification Allowance**

Method	Infiltration and direct storm inflow[a]
Area	1000 - 1500 gallons/acre/day
Pipe diameter-length	
Diameter 6-10 inches	500-650 gallons/day/inch diameter/mile
Diameter 12-24 inches	500-600 gallons/day/inch diameter/mile

[a] Data from ASCE Manual and Report on Engineering Practice No. 37, Design and Construction of Sanitary and Storm Sewers.

for infiltration and direct storm inflow is considered an appropriate basis for computing peak flows for those service areas where a normal range of infiltration and inflow has been exhibited in the past. For those where there is excess wet weather infiltration and direct stormwater inflow, it is assumed that remedial action will be taken and a design value of 1,500 gad is appropriate.

A knowledge of incremental increases of certain chemical constituents due to the municipal use of water is required for specific purposes, such as water reclamation and reuse of treated effluent, or for estimating the effects of wastewater discharge on downstream beneficial uses. The concentration of many minerals in a community water supply is altered markedly by its use for domestic, commercial or industrial purposes. Normal use of domestic water in residences produces an increase in total dissolved solids ranging from 200 to 300 mg/l, exclusive of wastes from from home regeneration of household water softeners. In general, commercial uses produce a comparable increase, whereas changes attributable to industrial use are governed by the nature of the industrial operations. Actual incremental increases presently occurring during municipal use in several communities in the southern portion of the Central Coastal Basin are listed in Table 15-12. It is evident that for most of the communities surveyed the regeneration of home water softeners and other commercial and industrial activities are causing a greater than normal increase in chemical constituents.

Of the many biological and chemical characteristics of municipal wastewater, those of principal concern to the selection and design of treatment processes in the southern Central Coastal Basin include 5-day biochemical oxygen demand, suspended solids, total nitrogen, total phosphate and toxicity.

By applying the unit design quantities to forecasts of population, land use, and industrial production from Chapter 12, it is possible to project wastewater flows and loadings which will be generated within the southern Central Coastal Basin.

Table 15-13 shows the future average daily mass emission rates of BOD_5, SS, TN-N and PO_4-P. The present geographic distribution and the relative change with time for these constituents are quite similar to the distribution of municipal flows, both with respect to time and planning sub-area. As shown the waste loads in the Santa Barbara Coastal Sub-basin will continue to be of the greatest magnitude. Growth in the Santa Maria River Sub-basin is expected to generate waste loads which will surpass those generated in the San Luis Obispo Coastal Sub-basin by the year 2000.

As with projections of population in the basin, the passage of time will be the only real test of wastewater flow or loading projections made in this study. Municipal waste load projections for this study have been estimated using the assumption that all nondiscrete industrial flows will be included in the municipal wastewater classification. In addition, it is assumed that the unit design factors chosen are the most appropriate for the southern Central Coastal Basin, based on present wastewater characteristics both within the study area and elsewhere. These factors must be kept in mind when comparing wastewater projections made in this study with those made by others.

Both the County of San Luis Obispo and the County of Santa Barbara have had master water and sewerage plans developed. The San Luis Obispo County Report on Master Water and Sewerage Plan was completed in May 1972. In general that study assumed that populations would increase at a faster rate than did the State of California Base Plan projections used in this study. That assumption led the San Luis Obispo County Report to predict average dry weather flows for communities in San Luis Obispo that in general exceed those estimated in this study. For example, the County report indicates that the Cambria area will generate an ADWF of about 1.6 mgd in the year 2000, while this study suggests that an ADWF of about 0.5 mgd will occur. Similarly the county report indicates that the Arroyo Grande-Grover City-Oceano area will generate about 3.8 mgd, while this study projects an ADWF of 1.4 mgd.

It should be emphasized that the estimated future flows in this study are based on the Base Plan population projections discussed in Chapter 12. Two other population projections were presented in Chapter 12, one that assumes a faster growth and one that assumes much slower growth than does the Base Plan projection. The recommended plan should be flexible enough to accommodate whichever population and resulting wastewater flow that may occur.

Although the southern portion of the Central Coastal Basin is not heavily industrialized, some industrial activity is a necessary part of water quality management planning. In general, industrial waste discharges can be classified as either discrete or nondiscrete. Nondiscrete waste discharges enter municipal or other public sewerage systems and are treated in the same treatment plants as domestic wastewater. The waste loads from these discharges were included in the determinations of present and future municipal waste loads.

Discrete waste discharges, on the other hand, are not intercepted by municipal sewerage systems. In this section the present and future industrial waste loads resulting from discrete waste discharges other than those involved in oil and gas production are identified. A summary of existing discrete industrial wastewater dischargers and current industrial waste loads is given in Table 15-14. The agricultural orientation of most of the study area is apparent.

Estimation of the magnitude of future industrial waste loads involves the consideration of many variables, many of which are beyond the scope of this study. Analysis of the projections of economic development presented in Chapter 12 suggests however that future industrial waste loads will remain fairly constant or decrease as a result of more stringent effluent limitations.

Data on solid waste quantities generated in the southern area are presented here. These data were developed on the basis of existing and projected populations and economic activity of various counties encompassed in the study area. Estimated unit waste generation factors were developed on the basis of the information contained in a state-wide survey which was conducted by the State Department of Health

Estimated per capita municipal solid waste loadings were developed on the basis of these statewide surveys.

Municipal solid waste has been classified by the State Department of Health into the following categories:

1. Residential Wastes:

Household garbage and rubbish

Lawn clippings and prunings

Furniture, appliances and miscellaneous items

2. Commercial Wastes:

Refuse from stores, markets, offices and shopping centers

Refuse from schools, churches, hospitals, public buildings, airports, etc.

3. Demolition and Construction Wastes

4. Special Wastes:

Street refuse (sweepings, leaves, tree trimmings)

Sewage treatment residue (sludge and screenings)

Dead animals (dogs, cats, etc.)

Automobile bodies

Total waste loading data were developed by utilizing unit waste loading factors and population data for the service area. Data on existing and projected municipal total waste loadings are presented in Table 15-15. In developing the data presented in Table 15-15 it was assumed that per capita waste loading factors will not change appreciably during the projection period. Considering the increased tendency toward source reduction and recycling of wastes, the above assumption may be rather conservative because a reduction in the per capita solid waste generation may be expected.

Data on existing and projected industrial solid waste loadings were developed on the basis of the results of the survey conducted by the State Department of Health by using projected employment figures which were developed during the course of the present study. The results of this analysis are summarized in Table 15-16.

Industrial waste loading data presented in Table 15-16 were developed by assuming that unit waste generation rate for the various industrial activities in the basin will remain the same throughout the projection period. Both of the above assumptions may be in disparity with actual conditions however, for the purposes of the present study further refinement of the waste loading data is neither warranted nor required. Projected industrial waste loadings were developed by extrapolating the results of the State Department of Health survey in the future on the basis of the employment projections which have been developed in this study.

Agricultural solid wastes originate from crop growing and animal husbandry operations. Crop residues are ordinarily integrated into the soil and do not pose any collection or disposal problems. Animal manures are generated at concentrated sources such as dairies, feed lots, and poultry farms and may pose difficult collection and disposal problems.

In the state-wide survey conducted by the State Department of Health, information was obtained on solid waste generation from agricultural operations. This information is summarized in Table 15-17. Data presented in this table reflect the conditions of the agricultural sector of the economy in the planning basin in 1968. However, no significant changes in agricultural production have occurred in this sector in the intervening period and the same loadings are assumed to be applicable to the existing conditions in the planning basin. It should be recognized that additional emphasis on vineyard development could change the character of agricultural solid wastes.

In order to develop projected agricultural solid waste loadings it would be necessary to conduct a detailed market and land use analysis, which is beyond the scope of the present study. Therefore in the absence of a solid basis for developing such projections it is assumed that the loadings presented in Table 15-17 will remain valid for the projection period.

Assumptions and methods used to identify and project vessel and recreation waste loads in the southern portion of the Central Coastal Basin were the same as those discussed previously for the AMBAG area. See Table 15-18.

The average annual volume of recreational wastewater estimated by the Department of Parks and Recreation and the assumed wastewater quality data were used to calculate the average annual recreational waste loads given in Table 15-19. These data indicate that a large portion of the recreational waste load is now and will continue to be generated in the San Luis Obispo Coastal Sub-basin

The oil and gas industry in California obtains its production generally from formations of marine origin. The marine deposits contain connate water with high concentrations of dissolved mineral salts.

The production of oil and gas results in an associated production of quantities of highly saline wastewater, oily wastes and other chemical wastes. The amount of wastewaters generated by any one oil field or in any one sub-basin varies with the characteristics of the particular petroleum deposits in that area.

Data on petroleum industry wastewater dischargers in the Central Coastal Basin were obtained from the Central Coastal Regional Water Quality Control Board, from Environmental Protection Agency applications for permits to discharge in navigable waters and from the California Department of Conservation, Division of Oil and Gas. There are 18 dischargers located in the Santa Barbara Coastal Sub-basin or about 60 percent of the total number of discharges in the southern portion of the basin.

The Department of Conservation, Division of Oil and Gas, has provided data on present oil and gas production wastewater volumes generated and disposed of in the study area. Extrapolations by decade to the year 2000 of the total amount of oil and gas production wastewater that will be disposed of in the study area have been made by the Division of Oil and Gas. Their projections indicate that wastewater production has already peaked in the basin and is on a downward trend. The rate of wastewater disposal will decrease to 66, 30 and 34 percent of 1970 rates by the years 1980, 1990 and 2000 respectively.

Non-point Source Waste Loads

Agricultural waste loads, urban runoff and other non-point source wastes were considered in the AMBAG and southern areas as part of the planning effort. As with point sources these studies considered these topics using somewhat different technical approaches; accordingly the basis for load computation is described for each of the two study areas.

Non-point Waste Loads — AMBAG Area

Management of agricultural wastewaters involves control of the quality and means of disposal of irrigation return waters and animal wastes where control is feasible. In the Central Coastal Basin agricultural waste loads from both sources are significant. In the following sections waste loads that result from agricultural activities have been forecasted.

Irrigated agriculture is a major land use, requiring a large portion of the total water used in the basin. It is important, therefore, to quantify the

Table 15-11. Present Municipal Flow Characteristics, 1970

	Contributing population	Mean annual flow, mgd[d]	ADWF		PDWF, mgd	Ratio of PDWF/ADWF	Wet weather inflow, gad[f]		
			mgd	gcd[e]			Infiltration	Direct storm inflow	Total
San Simeon Acres Community Services District	296	0.05	0.05	158	0.14	2.8	140	920	1,060
Cambria County Water District	1,692	NA	NA	NA	NA	NA	NA	NA	NA
Morro Bay - Cayucos	8,437	1.13	1.17	138	1.39	1.2	NA	NA	NA
California Mens Colony	5,099	0.61	0.56	110	1.36	2.4	670	NA	NA
San Luis Obispo	29,459	3.72	2.93	99	3.88	1.3	490	2,370	2,860
Avila Sanitary District	813	0.06	0.06	74	NA	NA	NA	NA	NA
Pismo - Shell Beach	8,320	0.25	0.85	101	NA	NA	NA	NA	NA
Lopez Recreation Area	NA	0.08	0.08	NA	NA	NA	NA	NA	NA
South San Luis Obispo County Sanitation District	10,150	0.82	0.82	80	1.50	1.8	50	840	890
Guadalupe	3,300	0.50	0.41	124	0.53	1.3	0	80	80
Santa Maria	33,000	4.30	4.89	148	7.98	1.6	70	300	370
Santa Maria Public Airport District	2,400	0.30	0.30	125	NA	NA	NA	NA	NA
Laguna County Sanitation District	16,600	1.16	1.21	67	1.80	1.6	NA	NA	NA
Lompoc	24,183	2.44	2.26	93			0[c]	875[c]	875
Federal Correctional Institution	1,721	0.19	0.17	101	NA	NA	NA	NA	NA
Solvang Municipal Improvement District	2,000	0.37	0.37[a]	185	0.60	2.5	150	750	900
Buellton Community Services District	1,500	0.06	0.17	115	0.42	2.4	0	1,540	1,540
Vandenberg Air Force Base	9,000	1.60	1.37	153	2.20	1.6	80	1,110	1,190
Cachuma County Sanitation District	NA	0.03	0.31	NA	NA	NA	NA	NA	NA
Goleta - Isla Vista	NA	6.10	6.10	NA	9.10	1.5	125	925	1,050
Santa Barbara	72,600	7.82	7.82	108	12.00	1.5	540 - 710	1,110 - 2,170	1,820 - 2,740
Montecito Sanitary District	4,636	0.75	0.75	161	NA	NA	125[b]	750[b]	875
Summerland Sanitary District	750	0.07	0.06	73	0.10	1.7	NA	NA	NA
Carpinteria Sanitary District	9,000	1.25	1.25	139	1.75	1.4	NA	NA	NA

[a] Brown and Caldwell, Solvang Municipal Improvement District Preliminary Design Study and Project Report, April, 1972.

[b] Brown and Caldwell, Montecito Sanitary District, Wastewater Management Study, July, 1972.

[c] Brown and Caldwell, Lompoc Valley Regional Wastewater Management Study and Preliminary Design, June, 1972.

[d] Million gallons per day

[e] Gallons per capita per day

[f] Gallons per acre per day

NA - Data not available

Table 15-12. Incremental Increases of Selected Chemical Constituents[a]

Service area	Incremental increase in concentration of indicated constituent during water use, mg/l		
	TDS	Sodium	Chloride
One domestic use	300	70	75
California Mens Colony	145	160	260
San Luis Obispo	525	120	140
Guadalupe	500	160	170
Santa Maria	550 - 730	165 - 215	205 - 270
Santa Maria Public Airport District	105	120	190
Laguna County Sanitation District	660	220	290
Lompoc	500 - 800	320	170
Federal Correctional Institution	130	95	45
Buellton Community Services District	600 - 680	280 - 310	360 - 390
Solvang Municipal Improvement District	490	155	185
Goleta Sanitary District	510 - 840	170 - 240	230 - 350
Santa Barbara	1,330 - 1,500	400 - 490	205 - 280
Montecito Sanitary District	570	175	225
Carpinteria Sanitary District	1,050 - 1,440	300 - 390	290 - 320

[a] Calculation of incremental increases based on a very limited number of chemical analyses.

Table 15-13. Waste Loading from Municipal Dischargers, Southern Area[a]

Sub-basin/discharger	Year	Flow rate, mgd	Waste loading, lbs/day			
			BOD	Suspended solids	Nitrogen	Phosphorus
San Luis Obispo						
San Simeon	1970	0.07	160	180	35	18
	1980	0.12	280	300	60	30
	2000	0.28	650	700	140	70
Cambria	1970	0.20	360	420	100	50
	1980	0.30	580	630	150	75
	2000	0.53	1,000	1,100	260	130
Morro Bay-Cayucos	1970	1.28	3,030	3,200	640	320
	1980	1.64	3,800	4,100	820	410
	2000	2.36	5,500	5,900	1,180	590
Los Osos-Baywood	1970	0.33	630	690	170	85
	1980	0.45	860	940	220	110
	2000	0.65	1,200	1,300	320	160
California Men's Colony	1970	0.56	1,100	1,200	280	140
	1980	0.71	1,400	1,500	360	180
	2000	0.93	1,800	1,900	460	230
San Luis Obispo	1970	3.24	7,600	8,100	1,600	800
	1980	4.32	10,000	11,000	2,200	1,100
	2000	6.36	15,000	16,000	3,200	1,600
Avila Beach	1970	0.12	180	200	60	30
	1980	0.17	260	280	85	43
	2000	0.29	430	480	140	70
Pismo Beach	1970	0.75	1,100	1,200	380	190
	1980	1.02	1,500	1,700	510	250
	2000	1.50	2,300	2,500	750	380
South San Luis Obispo CSD	1970	1.35	3,700	3,900	780	390
	1980	2.05	4,800	5,200	1,030	510
	2000	2.77	5,500	6,900	1,390	690
Lopez Reservoir[b]	1970	0.09	130	150	45	23
	1980	0.12	180	200	60	30
	2000	0.18	270	300	90	45
Soda Lake						
Soda Lake	1970	0.06	90	100	30	15
	1980	0.15	220	250	75	38
	2000	0.42	630	700	210	100
Santa Maria						
Santa Maria	1970	6.35	15,000	16,000	3,200	1,600
	1980	8.40	20,000	21,000	4,200	2,100
	2000	19.98	47,000	50,000	10,000	5,000
Guadalupe	1970	0.44	660	730	220	110
	1980	0.58	870	970	290	150
	2000	0.78	1,200	1,300	390	190
Cuyama Valley	1970	0.27	400	450	140	70
	1980	0.35	520	580	180	90
	2000	0.53	800	880	260	130

Table 15-13. Waste Loading from Municipal Dischargers, Southern Area[a] (continued)

Sub-basin/discharger	Year	Flow rate, mgd	Waste loading, lbs/day			
			BOD	Suspended solids	Nitrogen	Phosphorus
Santa Ynez						
Lompoc Valley	1970	3.79	8,900	9,500	1,900	950
	1980	4.94	11,000	12,000	2,400	1,200
	2000	9.14	13,000	14,000	2,900	1,400
Vandenberg Air Force Base	1970	1.26	2,400	3,600	630	320
	1980	1.51	2,900	3,100	760	380
	2000	2.28	4,400	4,800	1,100	570
Buelton	1970	0.17	330	360	85	43
	1980	0.40	770	830	200	100
	2000	0.70	1,300	1,500	350	170
Solvang	1970	0.60	1,100	1,200	300	150
	1980	0.79	1,500	1,600	400	200
	2000	1.52	2,900	3,200	760	380
Cachuma Reservoir	1970	0.19	290	320	95	48
	1980	0.24	360	400	120	60
	2000	0.38	570	630	190	95
Santa Barbara Coastal						
Goleta Sanitary District	1970	5.64	13,000	14,000	2,800	1,400
	1980	9.07	21,000	23,000	4,500	2,300
	2000	22.01	51,000	55,000	11,000	5,500
Santa Barbara Area	1970	7.99	18,000	19,000	4,000	1,900
	1980	13.28	31,000	33,000	6,600	3,300
	2000	20.92	49,000	52,000	10,000	5,000
Montecito Sanitary District	1970	0.70	1,400	1,500	350	180
	1980	1.50	2,900	3,100	750	380
	2000	1.98	3,800	4,100	990	490
Summerland Sanitary District	1970	0.07	160	170	35	18
	1980	0.09	210	220	45	23
	2000	0.15	350	380	75	38
Carpinteria Sanitary District	1970	1.03	2,000	2,100	520	260
	1980	1.69	3,200	3,500	840	420
	2000	3.30	6,300	6,900	1,600	800

[a] Based on Southern Area study information.

[b] Possible problem due to lack of space; loadings reflect areawide needs.

Table 15-14. Discrete Industrial Waste Loads - Southern Area

Subbasin/discharger	Standard industrial classification[a] Number	Description	Wastewater producing activity	Waste flows and loads, pounds per day unless otherwise noted: Flow, mgd	BOD5	SS	TDS	TN-N	PO_4-P	Oil and grease	Heat, million BTU per day	Receiving water
San Luis Obispo Coastal												
Pacific Gas and Electric Company Morro Bay Power Plant	4911	Electric services	Cooling	526	a	a	78.4[b]	1.4[b]	1.2[b]	a	48,200	Pacific Ocean
			Process	0.35	a	a	a	a	a	8.6		
Pacific Gas and Electric Company Diablo Canyon Power Plant	4911	Electric services	Cooling	2,500	a	a	a	a	a	210	374,900	Pacific Ocean
			Process	a	a	a	a	a		a	a	
Units 1 and 2 (begin operation 1973 - 74)												
Soda Lake												
None												
Santa Maria River												
Sinton and Brown Company	2034	Dehydrated fruits, vegetables	Dehydrates wet beet pulp for conversion to cattle feed	0.90	7,500[d]	a	a	675[d]	a	a	N/A	To land in Santa Maria Valley
Union Sugar Division of Consolidated Foods, Inc.	2063	Beet sugar refining	Washing and transportation of beets, sugar refining	8.9	1,500[e]	a	a	a	370[e]	a	N/A	To ponds in Santa Maria Valley
Airox, Incorporated	3272	Concrete products	Washing of exhaust for dust control	a	N/A	a	a	N/A	N/A	N/A	N/A	To ponds
Dow Chemical Company Dowell Division	3272	Concrete products	Truck washing	.0002	N/A	a	a	a	a	a	N/A	
Union Oil Company, Santa Maria Refinery	2911	Petroleum refining	Combined operating and process water, boiler and cooling tower blow down water, oil field brine	0.58	a	34	a	74	a	20	a	Pacific Ocean
San Antonio Creek												
None												
Santa Ynez River												
Grefco, Incorporated	3295	Minerals, ground or treated	Washing of exhaust for dust control	0.18	N/A	a	a	N/A	a	a	a	To ponds in Lompoc Valley
Santa Barbara Coastal												
None												

N/A - Not applicable

[a] Data not available

[b] Increment added during industrial activity

[c] Maximum emissions mentioned in discharge requirements

[d] Based on assumed constituent concentrations as follows: BOD_5 = 1,000 mg/l, TN-N = 90 mg/l

[f] Based on assumed incremental increase in constituent concentrations as follows: TDS = 4,000 mg/l

Table 15-15. Existing and Projected Municipal Solid Waste Loadings - Southern Area (Tons/Year)

	1970		1980		1990		2000	
	San Luis Obispo[a]	Santa Barbara	San Luis Obispo[a]	Santa Barbara	San Luis Obispo[a]	Santa Barbara	San Luis Obispo	Santa Barbara
Residential	36,500	121,000	41,000	152,700	49,600	213,000	56,400	277,000
Commercial	31,000	120,000	36,000	149,300	44,000	209,400	52,500	274,000
Demolition	6,000	31,000	6,900	38,500	10,000	55,400	12,200	73,400
Street refuse	4,550	15,750	5,300	19,900	6,500	28,000	7,400	36,400
Sewage residue	2,100	7,150	2,400	9,000	2,900	12,600	3,300	16,400
County total	80,150	294,900	91,600	369,400	113,000	518,400	131,800	677,200
Planning Basin total	375,050		461,000		631,400		809,000	

[a] For that portion of the county which is included in the planning basin.

Table 15-16. Existing and Projected Industrial Solid Waste Loadings - Southern Area (Tons/Year)

Type of industry	1970		1980		1990		2000	
	San Luis Obispo	Santa Barbara	San Luis Obispo	Santa Barbara	San Luis Obispo	Santa Barbara	San Luis Obispo	Santa Barbara
Food processing	6,000	28,300	10,000	38,800	14,000	49,200	18,000	59,700
Chemical and petroleum	-	-	-	-	-	-	1,000	2,000
Manufacturing	800	9,700	1,300	14,500	1,800	19,400	2,400	24,200
County total	6,800	38,000	11,300	53,300	15,800	68,600	21,400	85,900
Planning Basin total	44,800		64,600		84,400		107,300	

Table 15-17. Existing Agricultural Solid Waste Loadings, Southern Area (Tons/Year), 1968

Type of waste	Santa Barbara County	San Luis Obispo County
Animal manures	181,600	182,600
Fruit and nut crop waste	11,000	13,200
Field and row crop waste	135,600	261,300
County totals	328,200	457,100
Planning basin total	785,300	

Table 15-18. Present and Future Average Annual Vessel Waste Loads, Southern Area

County	Wastewater volume, million gallons per year	Mass emission rate, pounds per year			
		BOD_5	Settleable solids	TN-N	TP-P
San Luis Obispo					
1970	1.4	1,000	800	620	66
1980	1.7	1,200	1,000	760	80
1990	2.2	1,600	1,300	980	100
2000	2.6	1,900	1,500	1,200	120
Santa Barbara					
1970	2.2	1,600	1,300	980	100
1980	2.7	2,000	1,500	1,200	130
1990	3.7	2,700	2,100	1,700	170
2000	4.9	3,500	2,800	2,200	230

Table 15-19. Average Annual Recreational Waste Loads, Southern Area

Sub-basin/year	Average annual volume, million gallons	Mass emission rate, 1,000 pounds per year				
		BOD_5	SS	TN-N	TP-P	Oil and grease
San Luis Obispo Coastal[a]						
1970	66	99	99	77	5.5	12
1980	90	140	140	110	7.5	16
1990	120	180	180	140	10	22
2000	150	230	230	180	13	27
Soda Lake						
1970	.009	.015	.015	.011	.00075	.0016
1980	.012	.018	.018	.014	.0010	.0022
1990	.016	.024	.024	.019	.0013	.0029
2000	.019	.029	.029	.022	.0016	.0035
Santa Maria River						
1970	10	15	15	12	.83	1.8
1980	13	21	21	15	1.1	2.4
1990	17	26	26	20	1.4	3.1
2000	21	32	32	25	1.8	3.8
San Antonio Creek						
1970	1.9	2.9	2.9	2.2	.16	.35
1980	2.4	3.6	3.6	2.8	.20	.44
1990	3.2	4.8	4.8	3.7	.27	.59
2000	3.9	5.9	5.9	4.6	.33	.71
Santa Ynez River						
1970	18	27	27	21	1.5	3.3
1980	30	45	45	35	2.5	5.5
1990	59	89	89	69	4.9	11
2000	93	140	140	110	7.8	17
Santa Barbara Coastal						
1970	26	39	39	30	2.2	4.8
1980	34	51	51	40	2.8	6.2
1990	45	68	68	53	3.8	8.2
2000	54	81	81	63	4.5	9.9

[a] Waste loads for Lopez Recreation Area are included in municipal waste loads.

waste loads discharged to surface waters and to groundwaters.

Surface runoff from agricultural lands can occur when rainfall or irrigation rates exceed evapotranspiration and infiltration rates. Irrigation techniques can minimize the latter source of runoff from agricultural lands, but irrigation runoff will continue to occur in the study area. The waste loads carried by storm water runoff from agricultural lands have also been included in the estimates of nonurban runoff waste loads that are discussed in a later section of this chapter.

The effects of irrigated agriculture on groundwater quality are normally confined to changes in the inorganic chemical quality of the receiving water. These effects include increases in the total salt and nitrate content, increases in the ratios of sodium to calcium and magnesium and increases in the ratios of sulfate and chloride to bicarbonate ion concentrations. Studies have shown that the degradation of groundwater by potassium and phosphate from fertilizer addition is not significant. Increases in total salt have been found to be, in some cases, extremely detrimental to groundwater quality.

Irrigation wastewater returns were estimated by expanding and completing an analysis originally undertaken by the California Department of Water Resources. A simple annual water balance was utilized in this investigation to determine the return water.

Climatological data for the AMBAG area were obtained from several sources. An unpublished California Department of Water Resources office report, "A Method for Determining Vegetative Water Use and Related Factors", listed the precipitation and evapotranspiration values used in the applied water studies for the Salinas Valley. DWR files contained some data for Santa Cruz, Santa Clara and San Benito counties. Using this data, monthly and annual precipitation and evapotranspiration were estimated for each subarea. Return water unit factors were then estimated for each hydrologic subarea for each of six crop categories and were used together with the irrigated crop acreage projections to forecast the total agricultural flow to the system for each hydrologic subarea.

Water quality constituents added to the hydrologic system were estimated by determining average fertilizer application rates and crop uptake, and by estimating the resulting form of residual chemicals after they reached equilibrium with the soil matrix-chemical system.

Application rates of chemical constituents in fertilizers and amendments were estimated in a two step process. Average nutrient fertilization rates were estimated for specific crops and the chemicals contained in commercially mixed fertilizers were determined. Applied constituents were calculated for specific crops for three geographic locations within the AMBAG area. Nutrient application rates for typical fertilization practices and fertilizer compositions were estimated after consulting state specialists and farm advisors of the University of California Agricultural Extension Service, local fertilizer application service operators and fertilizer distributors.

Various research projects in recent years have developed a data base from which to calculate specific crop nutrient uptake. Nutrient uptake for the most significant truck crops in the AMBAG area has been investigated by the University of California Agricultural Extension Service. The data for each constituent has been reported in the literature as percent of dry matter of the harvested portion of the crop. In order to calculate the uptake in pounds per acre, estimates of harvested yield were needed. Data on historical yields for the study area were analyzed for past trends; future yields were forecast on the basis of this analysis.

Gross waste increments are defined as the difference of the applied chemical constituents and the crop nutrient uptake. Gross waste increments were estimated for specific truck crops and for five crop categories at representative locations in the planning area.

New waste increments are those constituents included in percolation water leaving the root zone due to the additions of fertilizer and soil amendments to cropped lands. The constituents included in the gross waste increments go through several equilibrium reactions as they move through the soil system. These equilibrium reactions, which affect $PO_4^{\equiv}$ and K^+, are complicated and difficult to predict accurately. Four basic equilibrium conditions were assumed and are listed below.

1. Irrigated soils in the study area are neutral or slightly acidic and, through cultural practices, will be maintained with a pH near 7.0, excess $PO_4^{\equiv}$ will precipitate with Ca^{++} in a form similar or related to $Ca_3(PO_4)_2$.

2. K^+ has a higher Zeta Potential than Ca^{++}, excess K^+ will replace Ca^{++} through ion exchange.

3. Deficiency of $PO_4^{\equiv}$ will be met by solution of $Ca_3(PO_4)_2$.

4. Deficiency of K^+ will be met by plant induced ion exchange removal of K^+ and its replacement with Ca^{++}.

These four assumptions were utilized to estimate the net waste increments. Table 15-20 gives the forecasts of net TDS returned to the hydrologic system attributable to agricultural practices in the Monterey Bay Regional Planning Area.

The production of livestock is an important activity in the AMBAG planning area and accounts for about one-third of the total agricultural waste load under both present and proposed year 2000 conditions. Present and forecasted livestock populations which contribute wastes are presented in Table 15-21. These include only the animal populations which are considered to be adding waste to the hydrologic system. Range cattle, horses and sheep are not included. The net effect of range animals on nutrient loads is negative since feed is not brought into the area. Also, poultry populations are not shown because their wastes are collected and sold to fertilizer manufacturers. Animal unit mass emission rates have been estimated by Water Resources Engineers, Inc.; the forecasted animals waste loads for the AMBAG area are given in Table 15-22.

There are 45 urban areas or communities in the AMBAG area. Limited data is available concerning urban runoff flows and mass emission rates of significant waste constituents in the Central Coastal Basin. Accordingly, the characterization of urban runoff waste loads presented here is based on studies of other similar urban areas which have been adapted for use in this area.

It was assumed that a variation of the "rational method" could be used to estimate runoff with acceptable accuracy. In the rational method runoff is related to rainfall intensity by the formula $Q = CiA$; where Q is the runoff rate, C is a runoff coefficient which depends on the characteristics of the drainage area, i is average rainfall intensity and A is drainage area. It was also assumed that 90 percent of the urban runoff will reach the receiving waters of the basin. The annual volume of urban storm water runoff in each sub-basin was calculated by multiplying an overall runoff coefficient by 0.9, by the total urban area in acres and by the average annual rainfall. Although this means of calculating urban runoff gives a rough approximation, for the purposes of this study it was judged to provide an acceptable estimate of the magnitude of the urban runoff wastewater load.

Although methods of estimating the quantity (volume) of urban runoff have been in use for more than 30 years, it has been only fairly recently that attempts have been made to quantify the quality of urban runoff. Because no studies of the quality of urban runoff have been conducted in the Monterey Bay Regional Planning area, the literature was reviewed for data with which to estimate concentrations of pollutants in urban runoff. By relating the characteristics of urban areas in the planning area to similar areas which have been investigated, pollutant concentrations in urban runoff have been assumed. Since the quality of urban runoff varies widely with season and with time during each storm, it must be stressed that the estimation method is relatively crude. Projected volumes of urban runoff were multiplied by the average concentration of various pollutant constituents. The results of those calculations are shown in Table 15-23.

The characteristics of nonurban runoff are related to the uses of the land, soil characteristics, quantities of material in and added to the land, the intensity of rainfall and the quantity of resultant runoff. Review of the literature yielded a range of estimates of constituent concentrations of certain pollutants in nonurban runoff. These data and estimated average annual volumes of nonurban runoff were used to obtain the average annual nonurban runoff waste loads given in Table 15-24.

Non-point Waste Loads – Southern Area

Proper management of agricultural wastewater involves control of the quality and means of disposal. In the southern portion of the Central Coastal Basin agricultural waste loads from irrigation return waters and animal wastes are significant. Waste loads that result from agricultural activities in the study area have been estimated and presented by sub-basin where possible.

Irrigated agriculture is a major land use in the southern Central Coastal Basin. It also demands a large portion of the total water used in the basin.

Approximately 20 to 50 percent of irrigation water returns to the resource pool for reuse by surface drainage or by percolation to groundwater supplies. It is important then to quantify the waste loads discharged to surface waters and to groundwaters.

Surface runoff from agricultural lands can occur when rainfall and/or irrigation rates exceed evapotranspiration and infiltration rates. Proper irrigation techniques can minimize the latter source of runoff from agricultural lands, but it does exist in the study area.

A greater problem exists when the aforementioned climatic/irrigation conditions are reversed and the evaporation potential exceeds the precipitation and available soil moisture. Irrigation, under such conditions, which exist in the basin, favors a concentration of salt in the return waters. Inorganic changes, due to irrigation, include increases in the total nitrate content of groundwaters and increases in the ratios of sodium to calcium and magnesium, and sulfate and chloride to bicarbonate ion concentrations. Studies have shown that the degradation of groundwater by potassium and phosphate from fertilizer addition is insignificant. Increases in total salt and nitrate-nitrogen, however, have been found to be extremely important, and, in some cases, extremely detrimental to groundwater quality. The California Department of Water Resources has provided data on the waste loads contributed to groundwaters in the southern portion of the Central Coastal Basin by irrigated agriculture. That information is presented in Table 15-25 and includes total nitrate-nitrogen and total dissolved solids added by irrigation waters to each sub-basin. Both the salts and nitrate-nitrogen originally in the irrigation water and the salt and nitrate-nitrogen added by leaching and other processes in the soil are included in the total waste loads.

The production of livestock and poultry products is an economic activity in the southern Central Coastal Basin. Available data indicate that horse and cow populations produce 10 to 15 times as much BOD_5 per animal as would one person. The present and estimated future livestock and poultry populations in San Luis Obispo and Santa Barbara Counties are presented in Table 15-26. A general estimate of the gross waste loads generated by these animal populations can be made by applying unit (per animal) mass emission rates to the population of each animal. Animal unit mass emission rates have been developed by the State Water Resources Board. An estimate of the average annual animal waste loads using the SWRCB mass emission rates is included in Table 15-27.

There are 30 urban areas or communities in the southern portion of the Central Coastal Basin. In all but three of these communities, separate sewers have been constructed for municipal wastewaters and for storm water runoff. In the previous section, the character, volume, and variation of municipal wastewater loads were discussed. Storm water considerations entered into that discussion because of the infiltration and direct inflow of storm waters into sanitary sewers which increases the volume of sanitary sewage during wet weather periods.

It has been only recently that the importance of urban runoff has been recognized. For that reason, limited data is available concerning urban runoff flows and mass emission rates of significant waste constituents in the southern Central Coastal Basin. Accordingly, the characterization of urban runoff waste loads presented in this chapter is based on studies of other similar urban areas which have been adapted for use in this area.

In order to assess the importance of urban runoff as a portion of the total waste load generated by man and his activities, the average annual urban runoff discharge to receiving waters has been estimated. The annual volume of urban storm water runoff in each sub-basin was calculated by multiplying 0.9 by an overall runoff coefficient, by the total urban area in acres, and by the average annual rainfall. It should be recognized that this means of calculating runoff is only approximate; however, for the purposes of this study it does provide an acceptable estimate of the magnitude of the urban runoff wastewater load.

The estimated total urban area in each of the sub-basins in the southern Central Coastal Basin by decade is developed in Chapter 12. It is significant that a large increase in urban land area in the Santa Barbara Coastal sub-basin is expected by the year 2000. Because the annual rainfall of each of the sub-basins is variable, the probability of receiving more or less than a specific annual runoff can be calculated. The probability is expressed as a percentage of time that each sub-basin will have less than a certain volume of urban runoff annually.

Although accepted methods of calculating the quantity (volume) of urban runoff have been in use for more than 30 years, it has been only fairly recently that attempts have been made to quantify the quality of urban runoff. Because no studies of the quality of urban runoff have been conducted in the southern Central Coastal Basin, the literature was reviewed to enable an estimate to be made of the concentrations of pollutants in urban runoff. By relating the characteristics of urban areas in the southern Central Coastal Basin to similar areas which have been investigated, average pollutant concentrations in urban runoff have been assumed. It must be stressed that these concentrations are, at best, gross averages. The quality of urban runoff varies widely with season and with time during each storm.

To calculate average annual urban runoff waste loads the volume of urban runoff was multiplied by estimated concentrations of each constituent derived from technical literature. The results of that determination are shown in Table 15-28. The values shown in Table 15-28 have a 50 percent probability of occurrence. Similar data for other probabilities can be calculated by applying appropriate factors from probability plots of average annual rainfall.

In order for the impact of urban waste loads on water quality to be adequately assessed, much more information on storm water quality and urban runoff frequency volume relationships is needed. Such data are essential since a knowledge of the frequency and time distribution of loading may be far more important than a knowedge of total loading. For example, a short high-peaked surface runoff carrying a high concentration of suspended matter could be expected to more seriously affect a receiving water than runoff which released the same volume of suspended matter over an extended period. On the other hand, when storm water enters an impoundment the annual volume of contaminants also takes on a special importance. In general, urban runoff water quality data must be recorded in a continuous or almost continuous manner so that the time rate of delivery of the constituent can be determined. Without this information, only very gross estimates of the impact of urban water quality inputs on receiving waters can be obtained. Comprehensive management of urban storm water quality cannot be achieved until pollutants are properly identified as to nature and rate of delivery for individual storm events, types of urban areas, seasonal and antecendent factors.

Just as important as the determination of loading data is establishing the relationship between urban runoff shock loadings and their effect on receiving water quality. It is necessary for the same general level of accuracy and precision of sampling and analyses to be applied both to the waste discharges and receiving water pollutant parameters in order for the relationship between the two to be quantified.

In general, however, certain conclusions can be drawn from the information that is available. In those communities with storm drain systems, preventive maintenance and strict control over discharges made to the storm sewer system are vital to the success of the system as a water pollution control device. Maintenance programs must control the amount of debris that enters street inlets and the amount of debris conveyed further into the storm sewer system. Street cleaning and maintenance of litter receptacles limits the amount of debris washed into storm sewer appurtenances. Underground catch basins retain floating material, grit, and other settleable debris to protect the quality of waters that receive discharges from storm drain systems and to protect the drains from excessive abrasion. Catch basins must be regularly cleaned to maintain their effectiveness; accumulated grit and organic debris such as leaves, grass clippings, animal droppings, and other materials must be removed to prevent their ultimate discharge to the receiving waters.

In a general sense, runoff is the residual of precipitation that is drained from the land after the demands of evapotranspiration have been met. The relationship of runoff to rainfall is usually not a simple one, however, as it is affected by local vegetation, soil characteristics and geologic and topographic factors whose influence may belie generalized relationships. Direct determination of nonurban runoff characteristics (both quality and volume) and their variation is, therefore, soundly based only on actual measurements.

In Chapter II, data concerning the volume and variation of runoff in several streams in the basin were presented. Data concerning the average annual volume of runoff per square mile developed in that chapter have been used to estimate the average annual nonurban runoff for each sub-basin. The volume of nonurban runoff per square mile was multiplied by the nonurban acreage (total acreage minus urban acreage) in each sub-basin to calculate average annual nonurban runoff volume.

The characteristics of nonurban runoff are related to the uses of the land, soil characteristics, quantities of material in and added to the land, the intensity of rainfall and the quantity of resultant runoff. Review of the literature yielded a range of constituent concentrations of certain pollutants in nonurban runoff. The estimated average annual nonurban runoff waste loads were determined. Those waste loads are presented in Table 15-29.

CLASSIFICATION AND RANKING OF WATERS

The thirteen hydrologic sub-basins identified for the Central Coastal Basin can be classified in terms of effluent or water quality limitations as related to methods necessary to achieve compliance with surface water quality objectives. The procedure has been outlined in a management memorandum (MM #20) issued by the State Water Resources Control Board, Division of Planning and Research. Classification follows from the basic legal requirements set forth in Section 302(a), cited earlier.

The actual classification procedure involves a determination as to whether compliance with water quality objectives established for navigable waters can be achieved with effluent limits prescribed for point sources under Section 301 (b) (2) of the federal act; this section requires all publicly owned treatment works to comply with Section 201 (g) (A) which states:

"(2) The Administrator shall not make grants from funds authorized for any fiscal year beginning after June 30, 1974, to any state, municipality, or intermunicipal or interstate agency for the erection, building, acquisition, alteration, remodeling, improvement, or extension of treatment works unless the grant applicant has satisfactorily demonstrated to the Administrator that —

"(A) alternative waste management techniques have been studied and evaluated and the works proposed for grant assistance will provide for the application of the best practicable waste treatment technology over the life of the works consistent with the purposes of this title."

Alternative waste management techniques for best practicable waste treatment were proposed by EPA in March 1974 for public comment. This document describes several waste management techniques involving treatment and discharge, including flow reduction and storm and combined sewer control. The report states:

"The selection of any particular treatment management technique should be governed by cost-effectiveness as well as by general environmental considerations. The requirement that any treatment works achieve the effluent reductions associated with secondary treatment continues in force as a minimum prerequisite for eligibility for federal funding. Requirements for additional treatment, or alternative management techniques, will depend upon several factors, including availability of technology, cost and the specific characteristics of the affected receiving water body."

Guidelines for best practicable treatment were approved by EPA in June 1974. Secondary treatment is now the basic requirement for surface water discharge with more stringent approaches as appropriate after 1983. Using this approach the question of achieving compliance with best practicable treatment for a particular stream segment may be unanswerable depending on whether the effluent limits are based on secondary treatment or on some stricter control. It has been assumed for purposes of this evaluation and classification that best practicable treatment is equivalent to secondary treatment for direct discharge to surface waters.

Problems in surface waters of the Central Coastal Basin are not extensive and are largely confined to bacteriological contamination of coastal waters in localized areas of Monterey Bay, eutrophication of the lower Salinas River and lower portions of San Luis Obispo Creek and excessive salinity due to the nature of local geology in the watersheds of such streams as Pancho Rico Creek and the Cuyama River. In the coastal water cases problems can be or have already been corrected by improved treatment of point sources including upgraded disinfection practices and outfall improvements. In the two eutrophication examples cited problems are complicated by the influence of non-point sources; where mineral quality is a problem in surface waters the causes are often natural, however agricultural drainage is a cause of high salt concentrations in some sub-basins — notably in the lower Salinas and lower Pajaro Rivers. None of these surface water problems is directly corrected by secondary treatment except for the disinfection aspect which is correctable by other measures.

Table 15-20. Total Dissolved Solids Additions due to Agricultural Cropping Practices AMBAG Area (Tons/Year)

Sub-area	1970	1980	1990	2000
Santa Cruz	989	1,100	1,290	1,334
San Lorenzo	33	37	40	42
Aptos-Soquel	440	245	390	407
Pajaro	24,189	26,880	30,280	31,645
Salinas	82,463	92,620	101,885	106,448
Carmel	110	122	255	267
Monterey Coastal	110	122	202	211
Total	108,334	121,126	134,342	140,354

Table 15-21. Livestock Populations, AMBAG Area

	1970	1980	2000
Dairy (heifers)	10,250	10,820	13,550
Dairy (EAU)[a]	13,310	14,060	17,600
Feedlot (head)	103,860	118,350	151,490
Feedlot (EAU)[a]	107,290	122,490	156,790
Range (cows)	101,080	110,720	141,650
Range (EUA)[a]	162,180	177,660	227,280
Total (EAU)	282,780	314,210	401,670

[a] Equivalent animal units

Table 15-22. Waste Loads from Livestock, AMBAG Area

Year	Waste loads, tons/year		
	Nitrate	Phosphate	Total dissolved solids
1970	27,087	4,538	55,677
1980	30,390	5,110	62,480
2000	38,630	6,510	79,590

Table 15-23. Annual Urban Runoff Waste Loads, AMBAG Area

Sub-basin	Year	Runoff volume, acre-feet/year	Mass emission rate, 1,000 lbs/year			
			BOD_5	SS	TN-N	PO_4-P
Santa Cruz Coastal	1970	5,000	270	3,400	34	5.4
	1980	6,600	360	4,500	45	7.2
	2000	10,000	545	6,800	68	11.0
San Lorenzo River	1970	34,500	1,800	22,500	225	36
	1980	46,000	2,500	31,000	310	50
	2000	70,000	3,800	47,000	470	76
Aptos-Soquel	1970	12,600	690	8,600	86	14
	1980	17,500	950	12,000	120	19
	2000	26,000	1,400	17,500	175	28
Pajaro River	1970	15,500	850	10,500	105	17
	1980	45,000	2,450	31,000	310	49
	2000	105,000	5,600	70,000	700	115
Salinas River	1970	23,000	1,250	15,500	155	25
	1980	29,000	1,550	19,500	195	31
	2000	41,000	2,200	27,500	275	44
Carmel River	1970	13,000	710	8,900	89	14.5
	1980	16,500	900	11,200	112	18
	2000	23,000	1,250	15,500	155	25
Monterey Coastal	1970	200	22	270	3	0
	1980	200	22	270	3	0
	2000	400	44	540	6	0

Table 15-24. Average Annual Non-Urban Waste Loads, 1970, AMBAG Area

Sub-basin	Runoff volume, 1,000 acre-feet/year	Mass emission rate, 1,000 lbs/year			
		BOD_5	Suspended solids	Nitrogen	Phosphorus
Santa Cruz Coastal	120	910	310,000	715	49
San Lorenzo River	128	970	230,000	760	52
Aptos-Soquel	50	380	132,000	300	20
Pajaro River	137	1,040	2,850,000	820	56
Salinas River	303	2,300	9,700,000	1,800	125
Carmel River	87	660	650,000	520	35
Monterey Coastal	305	2,300	9,700,000	1,800	125

Table 15-25. Irrigation Return Waste Loads - Southern Area

Subbasin/constituent	Mass emission rate, tons per years			
	1970	1980	1990	2000
San Luis Obispo Coastal				
TDS	79,000	82,000	86,000	89,000
Nitrate as N	2,200	2,300	2,400	2,500
Soda Lake				
TDS	2,200	2,500	2,700	2,800
Nitrate as N	65	71	77	80
Santa Maria River				
TDS	200,000	220,000	240,000	250,000
Nitrate as N	5,700	6,300	6,800	7,000
San Antonio Creek				
TDS	8,100	9,000	9,800	10,000
Nitrate as N	240	260	280	290
Santa Ynez River				
TDS	110,000	130,000	140,000	150,000
Nitrate as N	1,200	1,400	1,500	1,600
Santa Barbara Coastal				
TDS	20,000	19,000	16,000	14,000
Nitrate as N	630	580	510	440
Totals				
TDS	419,300	462,500	494,500	515,800
Nitrate as N	10,035	10,911	11,567	11,910

[a] California Department of Water Resources, Land and Water Use and Economic Projections, Task Report No. 1, July, 1972.

Table 15-26. Dairy and Feedlot Cattle Populations - Southern Area

	1973	1980	2000
Dairy	10,000	10,000	10,000
Feedlot	36,000	50,000	70,000

Table 15-27. Dairy and Feedlot Cattle Wasteloads - Southern Area[a]

	Dairy cattle			Feedlot cattle		
	Nitrogen as nitrate	Potential salts (excluding nitrate)	Total potential salts	Nitrate	Total salts (excluding nitrate)	Total salts
1973	803	1533	2336	1755	1170	2925
1980	803	1533	2336	2460	1640	4100
2000	803	1533	2336	3120	2080	5200

a Based on six months at 100 percent population and six months at 80 percent, values in tons.

Table 15-28. Present and Future Average Annual Urban Runoff Waste Loads, Southern Area

Sub-basin	Runoff volume, acre feet/year	Mass Emission Rate, 1000 pounds/year			
		BOD_5	SS	TN-N	PO_4-P
San Luis Obispo Coastal					
1970	8,300	450	5,600	56	9.0
1980	8,700	470	5,900	59	9.5
1990	9,400	510	6,400	64	10.
2000	9,700	530	6,600	66	11.
Soda Lake					
1970	190	10	130	1.3	0.2
1980	190	10	130	1.3	0.2
1990	200	11	140	1.4	0.2
2000	200	11	140	1.4	0.2
Santa Maria River					
1970	6,500	350	4,400	44	7.1
1980	7,700	420	5,200	52	8.4
1990	9,400	510	6,400	64	10.
2000	10,700	580	7,300	73	12.
San Antonio Creek					
1970	490	27	330	3.3	0.5
1980	510	28	350	3.5	0.6
1990	520	29	350	3.5	0.6
2000	530	29	360	3.6	0.6
Santa Ynez River					
1970	4,200	230	2,900	29	4.6
1980	4,600	250	3,100	31	5.0
1990	5,100	280	3,500	35	5.6
2000	5,400	290	3,700	37	5.9
Santa Barbara Coastal					
1970	18,100	980	12,000	120	20.
1980	24,100	1,300	16,000	160	26.
1990	34,900	1,900	24,000	240	38.
2000	45,800	2,500	31,000	310	50.
Total					
1970	37,800	2,050	25,400	250	41.
1980	45,800	2,500	30,700	307	50.
1990	59,500	3,240	40,800	410	65.
2000	72,300	3,940	49,100	490	133.

Table 15-29. Average Annual Non-Urban Runoff Waste Loads, Southern Area

Sub-basin	Runoff volume, 1,000 acre-ft/year	Mass emission rate, 1000 pounds per year				
		BOD_5	SS	TN-N	TP-P	Oil and Grease
San Luis Obispo Coastal	290	2,200	1,700,000	1,700	120	2,400
Soda Lake	2.9	22	980,000	17	1.2	24
Santa Maria River	5.9	45	4,000,000	36	2.4	49
San Antonio Creek	5.7	44	460,000	34	2.4	48
Santa Ynez River	31	240	2,000,000	190	13	260
Santa Barbara Coastal	43	330	730,000	260	18	360

There are many water quality objectives listed in Chapter 4 which are established based on beneficial use protection without prior knowledge of the present concentration of many of these water quality factors in the surface waters of the basin. For example data are not generally available on toxic metals, pesticides, insecticides or other organics such as polychlorinated biphenyls (pcb's) in Central Coastal Basin waters. It is possible that point sources may discharge large quantities of these materials at times; this is not expected to be a major problem in this basin although municipal discharges serving more heavily industrialized areas have been found to contain high concentrations of metals, pesticides and pesticide-like materials. Non-point sources, such as urban runoff, are often sources of lead, pcb's and other contaminants.

It has been determined that all surface waters in the Central Coastal Basin are either effluent limited or are not subject to direct point source discharge (CFR Sec. 130.11 and Sec. 131.203). The water quality segments which were found to approach a water quality classification are the Lower Salinas River (below Spreckles gauge), the San Lorenzo River and the lower portion of San Luis Obispo Creek. The lower Salinas River was seriously considered as a water quality class segment, however the following arguments were made to remove this classification:

1. The Salinas River flows directly into the ocean during flood stage, but as flows recede in the spring, a sand bar forms across the mouth as a result of high tides and wave action, and the outflow of surface water is halted except for a controlled overflow diversion from the rather large lagoon to carry excess water to Moss Landing Harbor.

2. Under natural conditions, the Lower Salinas River bed above the lagoon would be dry during the summer months. The Department of Water Resources' September 1965 Report 4103-024 entitled, "Water Quality Conditions, Lower Salinas River" states that:

"During low flow conditions the Lower Salinas River directly reflects the quality of the water discharges and agricultural drainage which make up more than 90 percent of its flow. On occasion water from Nacimiento Reservoir reaches the Lower Salinas River, however, this is the exception rather than the rule."

3. During the winter period of high flow, water quality conditions throughout the entire Lower Salinas River are excellent. There are no problems except high turbidity, which is a natural condition.

4. Agricultural supply from the Lower Salinas River is not a beneficial use. It was not recognized as a beneficial use in the June 5, 1961 policy statement adopted by the Central Coastal Regional Water Pollution Control Board, which was in force during the 1964-1965 DWR investigation. The Monterey County Farm Advisor's Office has advised that no known agricultural diversion occurs below the Spreckles gauge.

5. The 1965 DWR report states that:

"Within the area of investigation there is only one major agricultural drainage system which discharges directly to the Salinas River. This system known as the Blanco Drain serves a sparsely populated agricultural area of approximately 6000 acres."

6. The Blanco drain confluence with the Lower Salinas River is very close to the Lagoon, which has a high TDS level as a result of seawater overflow at high tide, and through the sand bar. At the time the bar is open, the seawater wedge has extended above the nearest downstream quality sampling station in the 1964-1965 DWR investigation, 1.3 miles downstream from the Blanco drain confluence. No possible purpose would be served by imposing a TDS limitation at or downstream from the Blanco Drain confluence.

7. During the summer months, TDS would not be a problem above the Blanco Drain confluence even if agricultural supply were designated as a future beneficial use, since the effluent from the two Salinas wastewater treatment plants meets the mineral standards for at least class 2 irrigation water. Recent measurements of low flow TDS above the Blanco drain show TDS on the order of 450 mg/l.

8. Below Blanco Drain, in the Lagoon, DO problems and extensive biostimulation occur. The Lagoon is closed by a sand bar during the summer period with limited overflow drainage to Moss Landing Harbor. The DO. problem results from excessive algae growth. The 1965 report states:

"The apparent high BOD . . . (at the quality sampling stations in the Lagoon) . . . was caused by the presence of algae in the water and not by a waste discharge."

9. If the secondary effluent from the two Salinas waste treatment plants and the inflow from the Blanco drain were prevented from entering the Salinas River, there would be no inflow to the Lagoon most of the time during the summer period. However, there would likely be DO problems resulting from nutrients carried into the Lagoon in the spring with the local runoff. It is likely that the Lagoon is a nutrient rich environment under natural conditions during the summer period.

10. The flow in the Lower Salinas River above Blanco Drain during the summer months generally consists entirely of the secondary effluent from the two Salinas waste treatment plants. These discharges are in compliance with the new federal effluent standards. It makes no sense to perform a waste load allocation for the otherwise dry river bed, but the question the Regional Board should address itself to is whether this effluent should be allowed to be discharged to the otherwise dry river bed.

11. The 1965 DWR report has described the summer conditions below the discharge points for secondary effluent from the two plants in the following terms.:

"The appearance of the river from directly below the Salinas No. 2 waste discharge (stream mile 13) to approximately stream mile 5 is one of an oxidation pond with sludge deposits clearly visible and a hydrogen sulfide odor usually present.

The appearance of the river at Station No. 2 (stream mile 12.46) directly below the Salinas No. 2 waste discharge is one of recent degradation with low DO values (see Figure 1) usually less than 4 parts per million (ppm), sludge deposits clearly visible and a noticeable sewage odor. Station No. 3 (stream mile 9.51) below both Salinas No. 1 and No. 2 waste discharges is a classic septic zone. Dissolved oxygen is at a minimum often going down to zero. Hydrogen sulfide and other foul odors are continuously giving off and bottom sludge deposits are black, septic and under active decomposition. The stream in this area presents a depressing picture to the senses which would discourage the most avid recreationist. The picture is much the same at Station No. 4 (stream mile 7.13) except for a slight increase in dissolved oxygen. At Station Nos. 5 (stream mile 4.65) and 6 (stream mile 3.5) reaeration is supplying dissolved oxygen to complete the oxidation of the remaining organic material and recovery is well under way.

The high fertility of this zone, however, leads to a new problem. The nutrients in the water promote large numbers of algae. Under the influence of sunlight these algal "blooms" produce large amounts of oxygen as high as 259 percent saturation (23.5 ppm), which helps to satisfy the requirements of the biological population. At night, however, the algae consume oxygen, causing severe oxygen depletion. Station No. 5 had daylight DO values of 10.6 and 13.3 ppm and night DO values of 4.5 and 1.0 ppm on September 17 and October 8, 1964, respectively.

12. It should be recognized that the use of the otherwise dry river bed for discharge of secondary effluent is an economic use which should be given consideration with alternative competing uses. The cost of diverting this effluent from the otherwise dry river bed should be less than benefits, both economic and aesthetic which would result if the discharge were prevented.

13. The water quality objectives of concern in the Lower Salinas River in the stretch from the Spreckles gauge to the Blanco Drain confluence are dissolved oxygen and biostimulants. If restrictive dissolved oxygen and nutrient objectives are set which apply to the secondary effluent in the otherwise dry river bed, it may be less costly for the dischargers to pond the effluent during the summer months. This might be done in the river bed immediately below the discharge points. Secondary effluent will not meet the proposed nutrient objectives of 2 mg/l total nitrogen and 0.2 mg/l total phosphorus.

14. There may be some benefit in having the secondary effluent flow in the otherwise dry river bed since it provides a water supply for fish and wildlife habitat. If tertiary treatment is required to provide a suitable water supply for this purpose, this should be considered enhancement rather than mitigation. Costs of an alternative water supply for this purpose should also be determined before arbitrarily requiring tertiary treatment.

Accordingly it was recommended that the designation, water quality class segment, not apply to the Lower Salinas River since:

1. Secondary effluent meets 1977 federal limitation.

2. Release to the otherwise dry river bed represents best economic use and provides a water supply for fish and wildlife habitat that would not otherwise be available.

3. TDS is not an applicable water quality objective.

4. Lagoon environment would be nutrient rich under natural conditions.

Whether the water quality class segment designation is removed or not, the discharge of secondary effluent to the otherwise dry river bed should be allowed to continue since:

1. This is the best economic use.

2. No significant problems would be solved by preventing the use of the otherwise dry river bed for this purpose.

3. The secondary effluent provides a fish and wildlife habitat.

The Regional Water Quality Control Board supported the above portion and the designation of water quality class was removed from present consideration by the State Water Resources Control Board.

The San Lorenzo River area was considered by the Regional Water Quality Control Board as a water quality class situation in May 1973. Subsequent reviews have removed this segment from consideration as a water quality class segment. Progress is being made in Scotts Valley toward eventual consolidation with Santa Cruz. Turbidity is still a problem in part of this watershed; however, septic tank systems once thought to be a problem in the San Lorenzo Valley appear to be functioning well at most locations. Surveys of septic tank areas in the San Lorenzo Valley were made by Regional Board staff during the past year.

The San Luis Obispo Creek situation has not been listed as a water quality class situation in past reviews by the Regional Board; however, the eutrophication situation in the lower portions of this segment warrant special attention. Chapter 5 describes a program of upgrading of point source discharges to San Luis Obispo Creek unless non-point sources are found to negate the benefits of such increased treatment as nutrient removal, effluent filtration or partial demineralization at the City of San Luis Obispo treatment plant. Relative to this, the EPA Water Strategy paper (February 1974) stresses that, "For the 1983 ambient water quality goal, the present definition of the legislative caveat 'where attainable' recognizes that naturally occurring conditions, or non-point source pollution could result in failure to meet that goal everywhere. However, it is not intended that point source pollution, whether individual or aggregate, be the prevailing reason for its nonachievement." Accordingly it is necessary to conduct a thorough study of conditions in San Luis Obispo Creek relative to point and non-point waste influences and to assess the present conditions of these waters and ecological systems dependent upon them. Certain problems exist behind a low sheet pile dam which impounds a significant portion of the lower creek upstream from Avila Beach. Water is taken from this impoundment for local golf course irrigation; in summer most of this water is of wastewater origin, being secondary effluent from the City of San Luis Obispo treatment plant upstream. Duckweed, algae and eutrophication-associated conditions are evident in this reach. The problem is compounded by institutional and legal constraints since the dam is on an old Spanish land grant. Upstream, cattle can be seen in the creek bed and wastes from agricultural operations clearly contribute to the problem. Accordingly, strict effluent controls at San Luis Obispo may not have any recognizable effect on nutrient-associated problems, bacterial densities or salt concentrations. Elimination of the discharge would tend to dry up this reach to the detriment of resident aquatic life, livestock watering and downstream irrigation. The reach should therefore be subjected to detailed assessment in order to stage improvements at the City treatment plant in a manner which is consistent with water quality improvements; to do this some control of non-point sources, including control of cattle wandering in the stream bed, will be needed. Left as it is, the lower reach will be a warm water associated habitat with eutrophication problems; however these waters are capable of sustaining life forms normally found in eutrophic waters including frogs and fish such as carp. Maintenance of this kind of habitat may be a valid use of this reach, depending on the value judgment of persons in this area. Wastewater treatment technology has not progressed to the point that nutrient removal can be accomplished on a consistent basis wherein resultant effluent quality is equivalent to that in an oligotrophic lake. Even if it were technically possible to do so, to convert the impounded stream to a trout habitat would displace the frogs. Advocates can be found for protection of both trout and frogs; certainly as food each is a delicacy. Protection of trout is probably more popular; however frog habitats are probably rarer in this part of California. Certainly subjective judgments will enter into this dilemma.

What can be said is eutrophication has its place and within limits is a desirable natural condition in some waters.

A ranking of surface waters was performed based on waste loadings and present or potential water quality problems. Previous rankings performed by the Central Coastal Regional Water Quality Control Board staff in May 1973 were reviewed and considered in the ranking process. Categories were used rather than a strict numerical rating since in many cases the problems are different and subjective judgments were involved. The categories were high (immediate water quality problems); medium (potential threat to surface waters) and low (where compliance with water quality objectives would be expected). The rankings for surface waters are listed in Table 15-30.

A ranking was made for groundwaters following the same approach used for surface waters. The ranking of groundwaters is included in Table 15-31.

Table 15-30. Ranking of Surface Water Segments[a]

Ranking	Sub-basin
High	Salinas River Aptos-Soquel Pajaro River San Lorenzo River San Luis Obispo Coastal
Intermediate	Santa Barbara Coastal Carmel River Santa Ynez River
Low	Santa Maria River Santa Cruz Coastal Monterey Coastal San Antonio Creek Soda Lake

[a] The above rankings pertain to man-caused effects. Rankings are explained below:

High - Immediate water quality problems

Intermediate - Potential threat to water quality

Low - Compliance with water quality objectives expected

Table 15-31. Ranking of Ground Waters[a]

Ranking	Sub-basin
High	Santa Maria River Santa Ynez River Salinas River Santa Barbara Coastal
Intermediate	San Luis Obispo Coastal Pajaro River San Lorenzo River Soda Lake Carmel River
Low	San Antonio River Aptos-Soquel Santa Cruz Coastal Monterey Coastal

[a] The above rankings pertain to man-caused effects. Rankings are explained below:

High - Immediate water quality problems

Intermediate - Potential threat to water quality

Low - Compliance with water quality objectives expected

SECTION 3. ALTERNATIVE CONSIDERATIONS

Chapter 16 Alternative Control Measures

State and federal laws require that "alternatives to a proposed action" be investigated prior to the implementation of actions significantly affecting the quality of the human environment. A rigorous, objective evaluation of alternative actions is required in order not to prematurely foreclose options which may be more cost-effective or environmentally sound than another possible action. This chapter is a response to that mandate; accordingly the range of water quality control principles considered is discussed, criteria and procedures used to develop and evaluate alternatives are outlined, and alternative water quality management plans are presented, compared and evaluated.

PRINCIPLES CONSIDERED

The scope of basin level planning and the range of alternatives developed and evaluated are a function of the water quality management principles considered during the planning process. It is helpful to outline those principles to further understanding, development, and evaluation of alternative wastewater management plans.

In previous chapters, the reader has been introduced to many of the water quantity and quality problems facing the study area. In this chapter, alternative means of solving present and possible future problems are investigated and alternative ways of protecting the beneficial uses of the waters of the basin are described and evaluated. The great variety of waste sources and the localized concentration of wastes generated in the study area require that a wide range of solutions be found and a wide range of water quality management principles be utilized.

The water quality management methods for point sources of wastewater are considered in terms of wastewater disposal approaches and the necessary treatment required to provide protection to receiving waters whether these are surface or groundwaters. Other methods considered include source control aspects and methods for disposal of sludges, brines and other residual wastes. Where water supply deficiencies contribute to water quality control problems these are considered in terms of total watershed management wherein controls are identified to upgrade water supplies. This aspect of source control is particularly relevant in areas of the southern portion of the Central Coastal Basin where groundwater quality is poor. In some cases wastewater reclamation can be encouraged where relevant water supply source controls are accomplished, particularly for wastewater irrigation reuse or groundwater recharge operations where municipal effluents are reduced in salt content by water supply improvements. Thus, total water management is encouraged in this basin plan.

Non-point sources are considered in terms of short-term and long-term improvements. Short-term improvements are principally related to changes in land use practices, whereas major long-term changes require considerations of land use planning including alternative land use patterns. The subject of land use planning and some of the legal and institutional problems presented by increased control of land are discussed later in this chapter and in Chapter 6. General alternatives for solid wastes, individual disposal systems and special water quality control alternatives, such as flow augmentation and conjunctive water management, are also discussed.

Planning strategies have been described in Chapters 4 and 15 wherein water quality objectives are established, and receiving waters are classified as either water quality or effluent limitation class depending on the nature of receiving waters and the possibility that treatment of point sources as required to meet effluent limits will accomplish desired objectives. Alternative water quality management plans are developed to accomplish desired controls and evaluated in terms of economics, functional factors and environmental impact.

A water quality class segment is defined as one where treatment to the effluent limits prescribed under Public Law 92-500 will not meet water quality objectives, accordingly higher levels of treatment are required.

Control Principles for Point Sources

Management of point sources such as municipal or industrial wastewater can include source control, collection, treatment, disposal and reuse. Where population density or other factors preclude individual wastewater treatment and disposal systems, wastewaters are collected in sewers and conveyed, by gravity if possible, to a wastewater treatment plant. After necessary treatment, wastewater disposal is accomplished by such methods as discharge to natural waters, evaporation, deep well injection, recharge of groundwater or evapotranspiration through irrigation reuse. Sludges, the solids separated from wastewater during treatment, are generally returned to the land or incinerated. In any case, wastewater must be disposed of in a manner which will protect the public health, prevent nuisance conditions and maintain receiving water quality consistent with its beneficial uses. These conditions determine the degree and often the type of treatment which must be provided prior to disposal.

The selection of wastewater treatment levels for alternative plans requires consideration of technology available, the nature of effluent discharge, water quality objectives, the extent that water quality will be affected by treatment and regulatory agency policies such as discharge prohibitions, effluent limits and eligibility for grant funding. This is a difficult gauntlet to run, yet treatment process selection can involve all these factors. Decisions in treatment process selection are discussed for each of the four general disposal modes considered; stream disposal, estuarine disposal, ocean disposal and land disposal. Disposal to lakes or confined sloughs is prohibited. Treatment considerations for various disposal methods and separate discussions of treatment for reclamation and reuse are provided in Chapter 5. Treatment levels developed for consideration are presented in Table 5-1.

Disposal considerations and source controls warrant technical review; criteria used directly affect ocean outfall design and land disposal requirements in particular while source controls may have a major affect on disposal method selection. Costs for ocean outfalls will be directly affected by their size, length and complexity as well as site characteristics; similarly costs for land disposal whether by spray irrigation, percolation or other means are affected by location, soils, and design assumptions affecting areal requirements whether these are application rates or storage needs. Stream disposal requires consideration of dilution and/or percolation; in the Central Coastal Basin, stream disposal is generally discouraged unless treatment is equivalent to reclamation; see Chapter 5.

Ocean Disposal

Marine wastewater disposal systems in California range from large municipal deep water systems discharging primary effluent and producing submerged effluent fields, to the smaller, shallow water disposal systems discharging chlorinated secondary effluent in a surface field. The mechanisms which control receiving water quality when an effluent is discharged through a marine disposal system into relatively shallow water are principally: (1) the initial dilution which takes place as the effluent rises, (2) subsequent dilution after the effluent-sea water mixture reaches equilibrium with its surroundings, (3) the movement of the effluent field under the influence of local currents, and (4) bacterial die-off. Initial dilution has been well defined through research and field investigation and technical literature provides a valid basis for design. Subsequent dilution of the effluent field, bacterial die-off and the effect of local currents can be analyzed using data collected from oceanographic investigations.

When wastewater is discharged into sea water, it is immediately subjected to a buoyant force proportional to the difference in density between the effluent and the surrounding sea water. This force bends a horizontal discharge towards the surface and accelerates its ascent. Because of the relative motion between the discharged effluent and the sea water, turbulence is generated and mixing takes place.

Where the surface waters are less alkaline or higher in temperature than at the bottom, a density slightly greater than that of the surface layer exists. In such cases, the mixture will either remain below the surface of the receiving body and continue to spread and disperse, or will be carried to the surface by the kinetic energy residing in the rising mixture, subsequently to sink below the surface and remain submerged. The dilution required to bring about submergence can be calculated once the temperature and salinity characteristics of the receiving waters are known. If field submergence does not occur, the effluent sea water mixture will rise to the surface and spread out as a part of the surface layer. See Fig. 16-1.

An understanding of the basic mechanisms of initial dilution led to the development of long submerged diffusers with a large number of small diameter ports for discharge of treated wastewater effluents. Where conditions are suitable, it is usually possible with a properly designed diffuser to consistently achieve initial dilutions in excess of 100 to 1. The factors which affect the degree of initial dilution are the water depth, the size and spacing of diffuser ports, the hydraulic head available to create an initial jet velocity, and the physical characteristics of the water mass overlying the diffuser. Once the physical characteristics of the receiving water have been determined, the designer can vary each of the other factors to arrive at an optimum design.

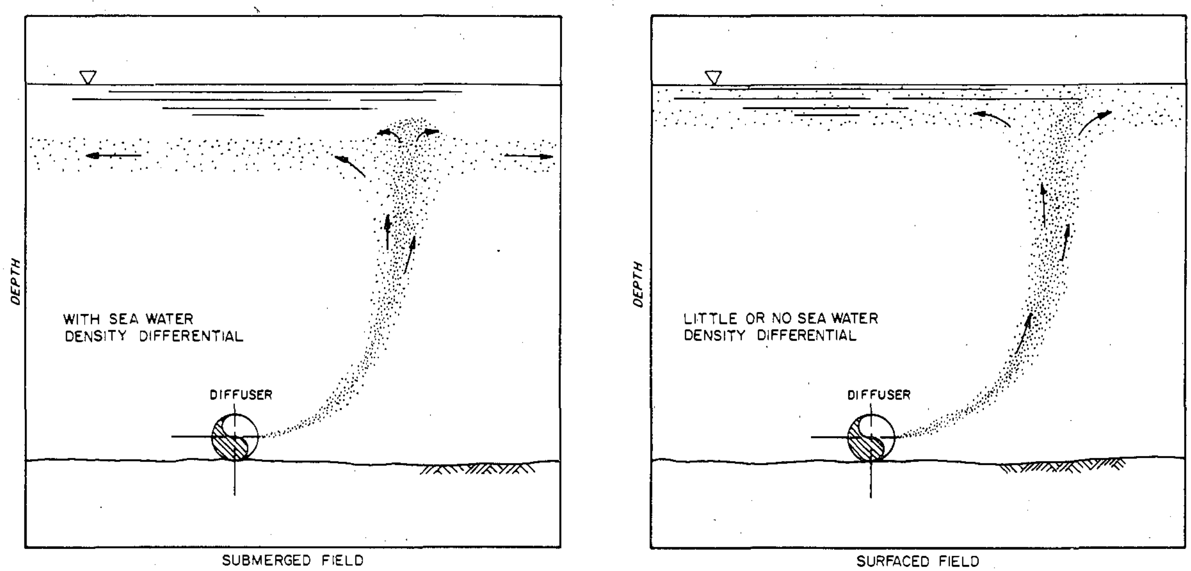


Fig. 16-1 Diffuser Dilution Characteristics

Depth of discharge, for example, is frequently influenced by economic considerations associated with a proposed outfall site. In some cases, many miles of pipeline are required to reach a discharge depth of 150 to 200 feet. In some circumstances, however, long diffusers with smaller diameter ports placed in shallower water will produce initial dilutions comparable to shorter diffusers in deep water.

The calculation of diffuser performance and initial dilution is a long and tedious mathematical process which makes it an ideal application for computer analysis. In the usual case, a number of jets discharging side by side soon merge to form a single buoyant jet which has the characteristics of a jet discharged from a line source. As the effluent field rises and becomes more dilute, its density is progressively computed and compared to the density of the sea water above. When the density of the field becomes equal to or greater than the surrounding sea water, the point and dilution at which the field will cease to rise is computed. Because of the momentum in the rising effluent plume, the submerged field will actually stabilize at a level slightly above the point of equilibrium, and this factor is included in the analysis.

The computer analysis considers dilution in turbulent jets due to momentum, buoyancy and stratification effects, but does not consider the effect of currents in the receiving waters. However, subsurface currents and turbulence will cause greater than predicted mixing and dilution.

After reaching equilibrium with its surroundings, whether submerged or in the surface layer, the effluent sea water mixture is subject to further mixing action which is defined as subsequent dilution. Subsequent dilution takes place by turbulent diffusion in the sea water mass as it is convected away from the outfall site. Except in unusual cases where strong vertical currents or turbulence exist, diffusion is much greater in the horizontal direction than in the vertical direction. Hence, the area of a field of diluting effluent increases much faster than its thickness. Compared with the very rapid initial mixing attained by the turbulent jet action, which may yield initial dilutions of 200 to 1 in a minute or two, subsequent mixing to attain a further dilution of 10 to 1 may take several hours.

Although dilution is the primary factor in reducing fecal bacterial densities as measured with the indicator, coliform organism concentrations in effluent discharged from a diffuser, coliform, and pathogens are also diminished by (1) bactericidal action of the sea water, (2) consumption by protozoans and other small organisms, (3) sedimentation and adsorption to other objects in the receiving water and (4) normal biological mortality or die-off.

Any test designed to measure true bacterial concentrations subsequent to discharge into a receiving water must therefore measure a combination of dilution and disappearance. For this reason, it is difficult to devise a means of comparison between observed oceanographic conditions and measured bacterial concentrations. Where adequate oceanographic data are available, a satisfactory answer can be obtained for subsequent dilution. To arrive at an answer for the rate of total coliform reduction per unit of time, the effect of the above four items must be estimated as a whole.

The evaluation of marine waste disposal alternatives must be made on the basis of reasonable criteria which are applicable to a wide variety of projects. Using these criteria, alternative projects can be evaluated and compared on the basis of cost and performance.

The factors which govern the design, location and successful performance of a submarine outfall may be divided into three classifications: ecological, oceanographic and physical. Ecological design criteria define the conditions which the discharge must meet to avoid a harmful effect on the marine evironment. Oceanographic design criteria include those physical oceanographic factors such as currents and water density which influence the performance of an outfall. Physical design criteria refer to factors such as waste composition and flow rate, and the characteristics of diffuser systems.

As described in Chapter 4, water quality objectives are related to specific beneficial uses; in addition waste discharge controls are grouped into one of the three basic long term water quality control strategies. For example, strategy number one provides for the complete elimination of all wastewater discharges from both point and diffuse (non-point) sources. In effect, this strategy would restrict the use of the land tributary to those coastal waters so designated. This is appropriate for the protection of those areas of special biological significance. For the southern portion of the Central Coastal Basin, this strategy is limited to those coastal waters in the vicinity of the Channel Islands.

Strategy number two would be designated for those specific geographic areas where there would be no direct point source wastewater discharges and regulation would be provided for the diffuse sources. An example of this type of an area might be one where the less controllable diffuse sources of pollution such as urban runoff have already utilized the waste assimilative capacity of a particularly sensitive nearshore marine life habitat. A nearshore zone providing a sensitive habitat for a rare or endangered species may fall under this strategy. These areas are described further in Chapter 6.

Strategy number three is the elimination of the discharge of identified pollutants. This strategy recognizes the requirements of the various receiving water beneficial uses and particularly the sensitivity of various marine habitats.

In general, marine biota are more prevalent in the intertidal and nearshore zones and decrease offshore and with increasing depth. As the quantity of wastewater discharged to the ocean increases, the relative potential adverse impact on the marine environment increases. Larger wastewater flows result in greater mass emission rates and have the potential to affect larger areas. Therefore, as a general rule, as the flow increases, the discharge should be located further offshore in deeper waters.

There are specific requirements in the California Ocean Plan relating to performance or efficiency of outfall diffuser systems in terms of initial dilution. For purposes of this study, the initial dilution will be defined as the centerline dilution of the rising plume which is the area of greatest concentration. The Ocean Plan states "diffusion systems should provide an initial dilution of wastewater with seawater exceeding 100 to 1 at least 50 percent of the time, and exceeding 80 to 1 at least 90 percent of the time." Since there is limited oceanographic data available in the southern portion of the Basin, the criteria with respect to dilution will be based on the expected extreme water temperature/salinity conditions in summer and winter. These conditions are based on oceanographic studies at Monterey Bay, offshore of Diablo Canyon, Santa Barbara and Montecito and those conducted in southern California by the Hancock Foundation from 1957 through 1960, although none of these studies had sufficient information to develop representative sets of profiles for winter and summer conditions.

Although the calculated dilutions do not consider the effect of currents, it is expected that the nearshore currents in the Basin, as discussed in Chapter 11, will not significantly increase this dilution. However it is desirable that natural local currents exceed 0.5 knots. Prior to design of any new ocean outfall or extension of an existing outfall, detailed oceanographic studies should be conducted to determine the currents in the disposal area. These should be such that the effluent field will consistently be dispersed from the general area without moving toward shore.

Those discharges that meet all of the wastewater effluent quality requirements of the Ocean Plan can be disposed of through ports as small as 1½ inches in diameter which substantially increase initial dilution efficiency compared to larger ports. Fig. 16-2 shows the initial dilution obtained for small diameter ports operating under both summer and winter conditions at relatively shallow depths. These dilutions were calculated using the previously described computer program and the port velocity applicable for average daily flow. Dilution obtained in the summer is less than in the winter for any given depth of discharge. This is generally the condition because in the summer, a density stratification exists and under these conditions, the effluent field rises only part way up in the water column before reaching equilibrium with the surrounding seawater and it will remain submerged below the surface. For the purposes of this study, the design initial dilution criteria for discharges meeting all of the effluent quality requirements in the Ocean Plan will not be less than 100 to 1 during the most critical design conditions, i.e. during the summer months. An anlysis of the data presented in Figure 16-2 indicates that the minimum depth of discharge to achieve this initial dilution requirement is about 35 feet. The distance offshore to a water depth of 35 feet in the southern part of the Basin varies from less than 1,000 feet offshore of the various headlands along the coast to about 3,500 feet at Shell Beach. Although this depth of discharge is appropriate for the relatively smaller flows, each alternative disposal site along the coast is evaluated on a case-by-case basis.

By discharging larger flows into deeper waters, through small diameter ports, the initial dilution can be increased to greater than 200 to 1 more than 50 percent of the time. The Ocean Plan provides that less restrictive effluent quality requirements may be set for specific parameters. It is appropriate then to assume that less restrictive effluent requirements should be considered on a case-by-case basis only when the initial

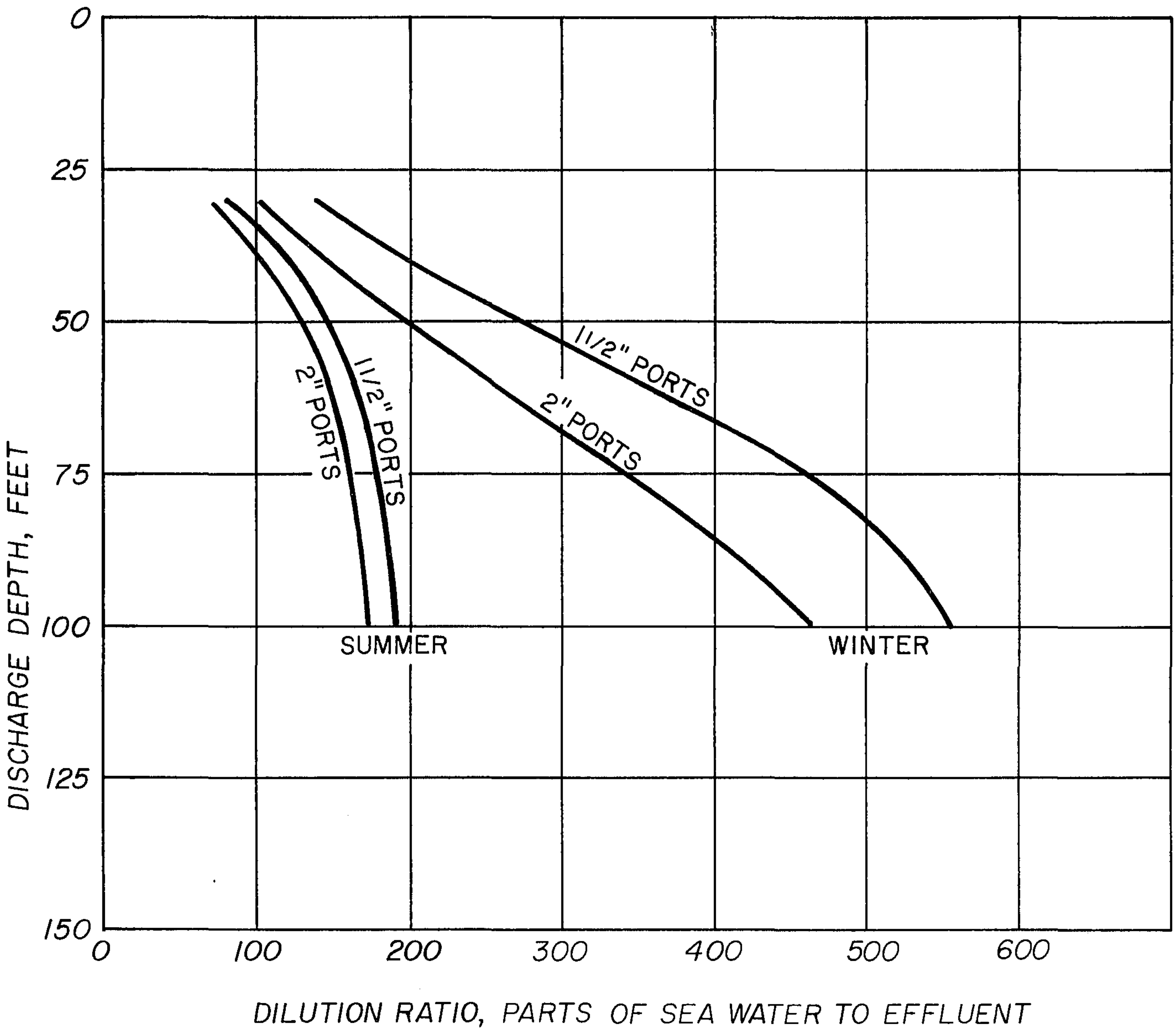


Fig. 16-2 Dilution Ratio, Parts of Sea Water to Effluent

dilution is greater than 100 to 1 more than 50 percent of the time.

As mentioned in the previous section, the Ocean Plan sets forth specific requirements for wastewater effluent characteristics. Table 16-1 summarizes these requirements. The effluent quality for Section A constituents (grease and oil, floating particulates, suspended solids, settleable solids and turbidity) may be less restrictive than those values given in the table, provided the discharge can comply with all of the water quality objectives stated in Chapter II of the Ocean Plan and all of the Section B effluent requirements listed in the table. As discussed under the oceanographic design criteria, less restrictive requirements would be considered only if the initial dilution 50 percent of the time or more, is greater than 100 to 1. A variance from these requirements would have to be accompanied by a comprehensive receiving water monitoring program to insure that all of the objectives set forth in Chapter II of the Ocean Plan are met. Wastewater effluent for all the ocean disposal alternatives investigated for this study will meet all requirements stated in Table 16-1, unless it is stated that an exception is assumed.

Another requirement of the Ocean Plan that is stated as a foot note is: "Waste that contains pathogenic organisms or viruses should be discharged a sufficient distance from shellfishing and body-contact sports areas to maintain applicable bacteriological standards without disinfection. Where conditions are such that an adequate distance cannot be attained, reliable disinfection in conjunction with a reasonable separation of the discharge point from the area of use must be provided." Large municipal marine disposal systems in southern California have for the past 10 to 20 years been discharging primary effluent at depths of 160 to 200 feet and maintaining submerged fields 90 to 95 percent of the time. The practice was developed specifically to avoid the high cost of chlorination for large flows, since bacteriological standards can be met consistently without chlorination when the field is submerged. In most cases for flows of 100 mgd or greater, it is more economical to discharge unchlorinated effluent at water depths of 150 to 200 feet than to chlorinate the effluent and discharge it at water depth of 100 feet or less. For flows of less than about 50 mgd, however, costs for chlorination and dechlorination and discharge at shallower depth may be more favorable.

Therefore, for the relatively smaller flows that occur particularly in the southern part of the Basin, it will be assumed that adequate disinfection will be provided at the treatment plant site. This will include flash mixing facilities and chlorine contact tanks designed for an adequate contact period.

To insure the reliability of chlorination for those discharges requiring protection level A, it is assumed that duplicate or back-up chlorination facilities will be provided. The Ocean Plan requires an MPN of coliform organisms less than 1000 per 100 ml within a zone between the shoreline and a distance 1000 feet offshore or to the 30-foot depth contour, whichever is further from the shoreline or a requirement of 70 per 100 ml in those areas where there is shellfish harvesting. This requirement would not apply for the deeper water discharges that can meet the Ocean Plan bacteriological requirements for the receiving waters without chlorination. Meeting this requirement at the plant site will not only provide for a maximum public health protection but will eliminate the necessity for bacteriological monitoring of the offshore receiving waters. The Ocean Plan also has a requirement for a maximum effluent chlorine residual of 1.0 mg/l 50 percent of the time. It may, therefore, be necessary to provide dechlorination facilities to meet this requirement while simultaneously meeting the applicable bacteriological requirements.

The diffuser system for an ocean outfall must have adequate capacity for not only the average dry weather flow but also for the projected peak wet weather flow. Initial jet velocities greater than 20 fps produce very little additional dilution and can be achieved only at the expense of increased head requirements. For this study, a maximum port velocity of 20 fps at peak wet weather flow was used as the upper limit. Considering a multiport diffuser with a constant port diameter and the relationship discussed above with regard to the peak to average flow ratio, the length of diffuser per unit flow will decrease as the average flow increases. The diffuser length per unit flow was calculated for various flows and with port diameters of 1½ inches. These calculations have been based on a port spacing of 6 and 12 feet on each side of the pipe.

The general relationship of diffuser length per unit flow with respect to average flow is shown on Figure 16-3. The figure shows curves based on diffuser lengths with 1½ inch ports at 6 feet. These curves are then identified with respect to

Table 16-1. Ocean Plan Effluent Quality Requirements

Constituents	Concentration not to be exceeded more than:[a] 50% of time	10% of time
Section A		
Grease and oil (hexane extractables)	10.	15.
Floating particulates (dry weight)	1.0	2.0
Suspended solids	50.	75.
Settleable solids, ml/l	0.1	0.2
Turbidity, JTU	50.	75.
pH, units[b]	6.0 - 9.0	6.0 - 9.0
Section B		
Arsenic	0.01	0.02
Cadmium	0.02	0.03
Total Chromium	0.005	0.01
Copper	0.2	0.3
Lead	0.1	0.2
Mercury	0.001	0.002
Nickel	0.1	0.2
Silver	0.02	0.04
Zinc	0.3	0.5
Cyanide	0.1	0.2
Phenolic compounds	0.5	1.0
Total chlorine residual	1.0	2.0
Ammonia, as N	40.	60.
Total identifiable chlorinated hydrocarbons[c]	0.002	0.004
Toxicity concentration, tu[d]	1.5	2.0
Radioactivity	-[e]	-[e]

[a] Units in mg/l unless otherwise stated

[b] At all times

[c] Summation of individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

[d] Toxicity concentration expressed in tocicity units (tu) = $\frac{100}{\text{96-hour TL-50\%}}$

[e] Not to exceed the limits specified in Title 17, Chapter 5, Subchapter 4, Group 3, Article 5, Section 30285 and 30287 of the California Adminstration Code.

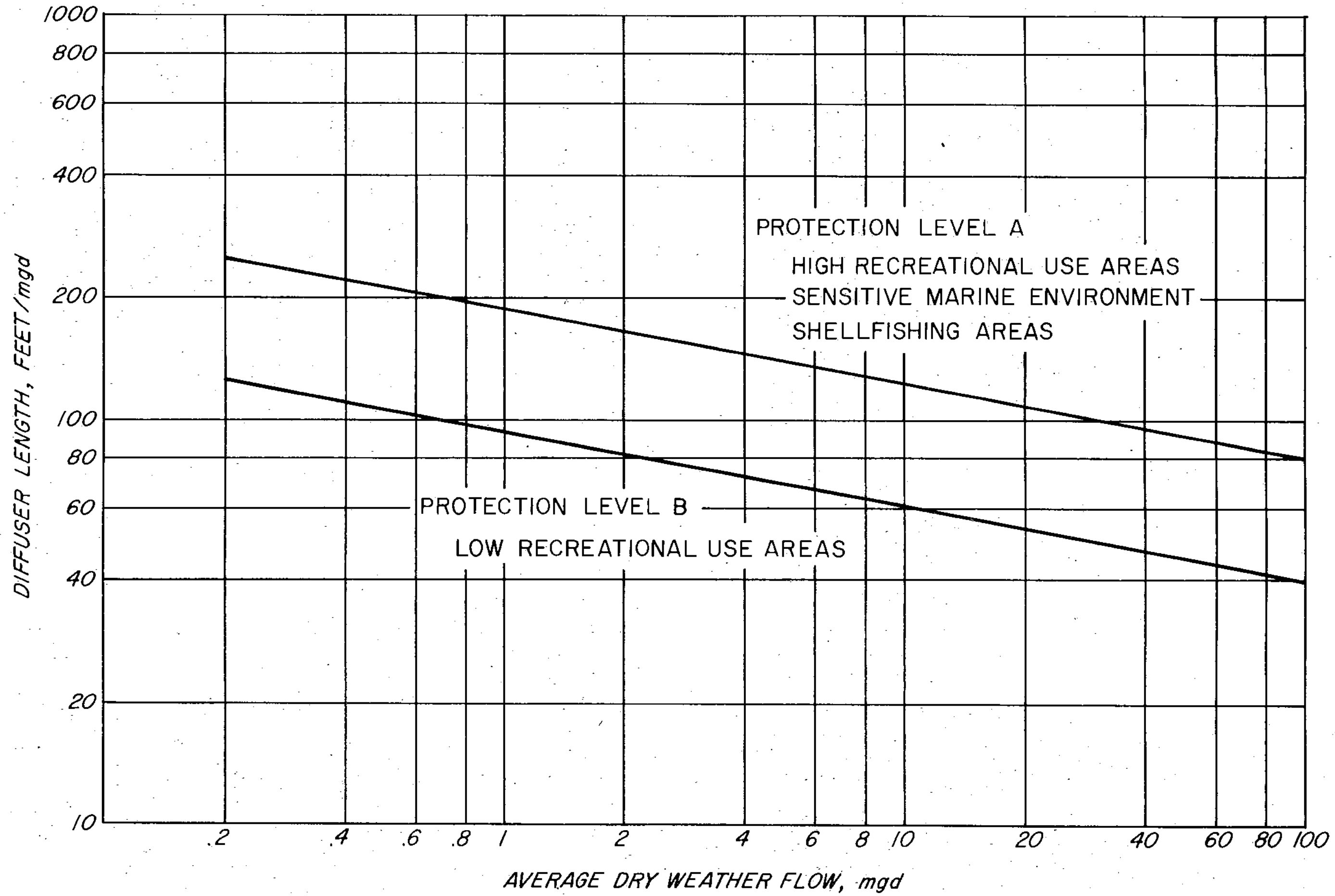


Fig. 16-3 Relationship between Diffuser Length and Flow

the alternative protection levels A and B. The curves are used in this report to determine the total length of diffuser for the various alternative marine disposal systems.

As indicated earlier, one of the Ocean Plan requirements for marine disposal of treated and disinfected wastewaters that potentially might contain pathogenic organisms or viruses is that they must be discharged in an area that provides a reasonable separation from the area of use. For purposes of this study, those areas that require level A protection, a reasonable distance is assumed to be 1,000 feet further offshore from the 35-foot depth contour. The 35-foot depth is the minimum depth where an initial dilution of 100 to 1 is obtainable. Although at this distance the corresponding depth varies depending on the offshore topography, the diffuser is generally located in about 40-45 feet of water in the southern part of the Basin. For those discharge areas requiring level B protection, it is assumed that discharging at a water depth of 35 feet is sufficient. In either case, field studies and evaluation of beneficial uses would be necessary to determine more accurately the relevance of these criteria at a project report level.

The Ocean Plan requirements previously discussed and the design criteria that have been developed for water quality control strategy number three are summarized as follows:

Level A Protection

(a) Minimum initial dilution of 100 to 1

(b) Minimum discharge depth equivalent to that depth which is 1,000 feet offshore of the 35-foot depth contour

(c) Duplicate chlorination facilities

Level B Protection

(a) Minimum initial dilution of 100 to 1

(b) Minimum discharge depth of 35 feet

Also those shallow water discharges meeting all of the effluent quality parameters of the Ocean Plan will meet as an effluent requirement the bacteriological requirement designated by the Ocean Plan for the receiving water zone. Dischargers may request less restrictive effluent requirements listed in Section A of Table 16-1, if the initial dilution is greater than 100 to I more than 50 percent of the time.

Marine waste disposal alternatives designed in this report are in accordance with the above criteria and as a general rule, as the quantity of wastewater flow increases, the discharge is located further offshore in deeper waters. It must be emphasized, however, that each alternative is evaluated on a case-by-case basis.

Land Disposal

The land disposal alternatives considered later in this chapter are designed to prevent runoff of applied wastewaters to surface waters and require that sufficent prior treatment of wastewater occur so that groundwater quality is not impaired. In this section, various land disposal methods are discussed, wastewater quality requirements are outlined, and the design criteria used in this study are developed.

There are many methods for the disposal of wastewater to land, including evaporation ponds, percolation basins, deep-well injection, and flood and spray irrigation systems. Septic tanks and their associated leaching fields have long been used for land disposal of wastewater from individual dwelling units; however, these cannot be considered applicable for any but small community systems. The technique appropriate for any specific disposal site is dependent upon climate, topography, soils, and groundwater conditions. Except for deep-well injection, the methods of land disposal generally tie up large areas of fairly level land.

Land disposal of wastewater fundamentally entails two disposal mechanisms: percolation, that is, water movement through the soil mantle and substrate, and evapotranspiration. Each of the land disposal methods mentioned above utilizes the two disposal mechanisms to a varying degree. Because, in the Central Coastal Basin, spray irrigation and percolation are considered the two most appropriate land disposal methods, the following discussion emphasizes those methods.

With an adequately designed spray irrigation land disposal system, essentially all of the applied water is lost to the atmosphere through evapotranspiration, with lesser amounts infiltrating into the soil. With percolation systems the soil mantle is used to renovate percolating waters and minor evapotranspiration losses occur. Establishment of design criteria for land disposal systems, therefore, calls for a determination of ambient evapotranspiration rates and general soil infiltration and percolation rates.

Because well-managed grass or pasture crops provide nearly 100 percent ground cover throughout the year, these crops have been selected as the standard crops for evapotranspiration comparisons. Thus, the evapotranspiration rate of a large well-watered, low-growing crop at full ground cover and of about the same color as grass is termed the potential evapotranspiration (PET). The PET values measured at stations representative of the Central Coast fog belt and the Central Coastal Valley zones are compared to monthly precipitation values.

Table 16-2 is an estimation of the average monthly water requirements for crop irrigation for an 8-month application period between April and November in both the Central Coast Zone and Central Coastal Valley Zone. Based on the analysis presented in Table 16-2, which assumes a 70 percent irrigation efficiency, from 41.9 to 42.4 inches or about 3.5 feet of water are needed to satisfy crop requirements during this period. Where subsoil constraints do not preclude irrigation, hydrologic data indicate a unit land requirement of about 210 acres per mgd for spray irrigation systems should be used for planning purposes.

The second land disposal mechanism is infiltration of wastewater into the soil and percolation through the soil to the groundwater body. The rate at which water can infiltrate through the soil surface depends on the soil's characteristics and condition. Soils in most of the study area have been classified according to their hydrologic characteristics by the U.S. Department of Agriculture, Soil Conservation Service. These data have been used in the selection of spray irrigation and percolation basin land disposal sites.

Percolation basins are usually most economically located in areas with high soil infiltration and percolation rates to minimize land costs and to minimize the risk of potential soil clogging problems. A certain degree of soil permeability is also necessary for spray irrigation areas to allow leaching of salts accumulated in the root zone by evapotranspiration.

The quality of wastewater disposed of on land must also be considered in the development of land disposal systems. Constituents of concern in spray irrigation land disposal systems are mainly those which can affect the viability of the vegetation being used as the disposal means, although the effect of leaching concentrated salts on groundwater quality must be considered. Constituents of concern in percolation systems are those which might impact upon the quality of useful groundwaters, particularly nitrates.

The quality of irrigation waters is classified by agricultural authorities according to their salt content, including the concentration of problem salts such as boron. A notable quality difference between the present wastewater effluents and most irrigation waters is the high wastewater nitrogen content. Although nitrate-nitrogen is a fertilizer, wastewater commonly contains from two to four times the nitrogen required for plant growth. Soluble nitrates have accumulated in the soil below some land disposal sites. Nitrate removal is often necessary where soils are porous to prevent groundwater degradation, particularly where domestic water supplies are a concern. The concentration of nitrate in groundwaters used as a drinking water supply is of concern because of the relationship between high nitrate concentrations in water and infant methemoglobinemia, a disease characterized by certain blood changes and cyanosis, which may be caused by high nitrate concentrations in the water used for preparing feeding formula.

In general, grasses are salt tolerant and are used as the vegetative cover for many spray irrigation land disposal systems. There is no mixture of grasses that is universally best for all situations. Climate, soils, slopes and other types of vegetative cover will have an influence on the ultimate success of any grass seed mixture. Because of competition between different species, the proportions of the different grasses may not be significant since the dominant species will take over. For this reason, some reseeding may be required from time to time. The following mixture has been found satisfactory for watershed areas used for waste disposal where some grazing is practiced; they could be mixed in equal proportions and seeded at a rate of 15 lbs. per acre: Perennial Rye Grass, Birdsfoot Trefoil, Orchard Grass and Alta Tall Fescue.

Other perennial grasses could be considered. In selecting species, preference should be given to deep-rooted plants with foliage configurations which maximize interception of spray to encourage evaporation losses. Harvest of grasses such as hay will remove some nutrients and salts from the disposal site. Remaining dead plant materials will aid in retaining soil friability.

Salt accumulation in the root zone is common to

Table 16-2. Historic Monthly Water Requirements for Crop Irrigation

Evaporative demand zone - month	Water depth, inches			
	PET[a]	Precipitation[b]	PET minus precipitation[c]	Irrigation requirement[d]
Central Coast Zone				
December	1.7	1.7	(0.0)	0
January	2.0	5.5	(-3.5)	0
February	2.7	3.3	(-0.6)	0
March	3.1	2.9	(0.2)	0
April	3.3	0.3	3.0	4.3
May	4.1	0.2	3.0	5.6
June	4.6	0.0	4.6	6.6
July	4.9	0.0	4.9	7.0
August	4.9	0.1	4.8	6.9
September	4.1	0.3	3.8	5.4
October	3.3	0.4	2.9	4.1
November	2.1	0.5	1.6	2.3
Total	40.8	15.2	-	42.2
Central Coastal Valley Zone				
December	1.7	2.0	(-0.3)	0
January	1.8	3.0	(-1.2)	0
February	2.7	1.8	(0.9)	0
March	2.4	1.9	(0.5)	0
April	4.7	1.5	3.2	4.6
May	4.4	0.2	4.2	6.0
June	5.3	0.0	5.3	7.6
July	5.3	0.1	5.2	7.4
August	3.9	0.0	3.9	5.6
September	3.6	0.1	3.5	5.0
October	3.3	0.3	3.0	4.3
November	2.5	1.5	1.0	1.4
Total	41.6	12.4	-	41.9

[a] Mean monthly potential evaporation.

[b] Mean monthly precipitation.

[c] Positive sign indicates water deficit, negative sign indicates water surplus.

[d] Parentheses denote non-irrigation period.

irrigated agriculture whenever water supplies contain salts which are not leached away. The process of evapotranspiration removes water from the soil around the roots of plants leaving most of the dissolved minerals behind in a soil solution. As soil salinity increases, corrective measures, such as leaching water application or drainage facilities, may be needed to prevent loss of soil productivity.

To illustrate the significance of the leaching requirement, the following conditions are assumed: uniform areal application of irrigation water; no rainfall; no removal of salt in the harvested crop; and no precipitation of soluble constituents in the soil. Also, the calculation is based on steady-state waterflow rates or the total equivalent depths of irrigation and drainage waters used over a period of time. With these assumptions, moisture and salt storage in the soil, depth of root zone, cation-exchange reactions, and drainage conditions of the soil do not need to be considered, provided that drainage will permit the specified leaching.

Leaching, in irrigation practice, is the process of dissolving and transporting soluble salts by the downward movement of water through the soil. Because salts move with water, soil salinity depends directly on water management, i.e., irrigation, leaching and drainage. These three aspects of water management must be considered collectively in the over-all plan for spray irrigation systems if maximum efficiency is to be obtained. Leaching is essential, particularly where applied water is limited; in wastewater disposal cases the governing criteria pertain more to control of excess applied waters to avoid runoff, and leaching requirements generally do not govern.

As noted earlier, the effect of percolating waters on the quality and quantity of groundwaters must also be considered. Percolation of wastewaters must not restrict the beneficial uses of groundwater. Of particular concern in the Central Coastal Basin are the quantities of salts (TDS) and nitrate being added to groundwater supplies by land disposal systems. High concentrations of salt can limit the usefulness of groundwater as an agricultural and public drinking water supply. Quality of percolating waters is affected by transport phenomena (convection, diffusion) and sources and sinks for water quality constituents. Because of sources (evapotranspiration, mineral dissolution, desorption, ion exchange, microbial and chemical degradation, etc.) and sinks (fixation, mineral precipitation, sorption, microbial and plant assimilation, etc.), the soil solution and the percolating water rarely have the same composition or concentration as the applied waters. Some of these sinks are irreversible, others are reversible, and still others may range between these extremes.

It is quite difficult to predict future changes in groundwater quality because of lack of adequate background data. However, several points of speculation are in order, despite limited information. The rate at which groundwater quality may change is highly dependent upon natural surface and groundwater flows, surface water management including wastewater disposal, loadings of particular water quality constituents, and the sources and sinks. TDS, alkalinity and hardness among other constituents may increase in the percolating water under cropped irrigated lands. With better quality imported water supplementing local supplies, improvements in wastewater quality can be expected although it may take decades for such changes to occur in the local groundwaters. Because of the long residence time for groundwaters to be recycled or displaced, it is highly imperative that proper management be undertaken to protect groundwater quality.

The foregoing have been used to formulate design criteria for the land disposal alternatives discussed later in the chapter. Criteria have been developed concerning the evaluation of potential land disposal sites and the choice of appropriate wastewater application rates.

As noted previously, the two major land disposal techniques considered appropriate to the study area are spray irrigation and percolation. Site selection criteria for each of these disposal techniques are included in Table 16-3. It should be noted that the criteria presented in Table 16-3 serve only as a general guide. By varying the wastewater application rate, it is possible to use some areas which would ordinarily not qualify.

Wastewater application rates for spray irrigation systems should be designed for minimum water intake rates (infiltration). They should also be constrained by runoff and erosional hazards, water-holding capacity, internal drainage, and impact on vegetation. In some soil profiles, the surface soil may limit the rate of water entry, and in others, the subsoil conditions may be rate limiting. If surface conditions limit water intake

Table 16-3. Land Disposal Site Selection Criteria

	Acceptable values	
	Spray irrigation	Percolation
Physical		
Surface slope	Less than 30 percent	Less than 15 percent
Soil type[a]	A, B, or C	A or B
Soil depth	At least 5 feet	NA
Depth to groundwater	At least 5 - 10 feet	More than 15 feet
Environmental		
Planned land use	Other than urban	
Flood hazard	Would not be inundated by the 100-year flood	
Archeological value	No known sites	
Habitat value	Would not encroach on rare or endangered species habitat	

[a] Soil Conservation Service Hydrologic Soil Group, wherein percolation rates are rapid in the A soils, moderate in B soils, and slow in C soils.

Table 16-4. Land Disposal Application Rates

Method-constraints	Unit land requirement, acres per mgd[a]	Application rate, gpd per acre	Storage requirement, months
Spray irrigation			
Slope less than 30 percent			
Soil types A & B	160	6,300	4
Soil type C	200	5,000	4
Slope greater than 30 percent	300[b]	3,400	4
Percolation			
Soil type A	5.5	180,000	Varies with character of natural recharge
Soil type B	11.0	90,000	

[a] Unit land requirement is the amount of land area needed to dispose of 1 mgd of treated wastewater. Because, in fact, spray irrigation with storage is assumed to occur only 8 out of 12 months, the actual amount of land required is 1.5 times the unit land requirement indicated above if an alternative disposal option is not used during wet weather.

[b] Spray irrigation marginal and not normally recommended unless circumstances require development of such an alternative; strict land management controls required.

rate and/or soil permeability, certain management practices can improve soil structure and permeability; for example, application of chemical amendments such as gypsum, tillage, cover cropping with sod, or increasing the electrolyte concentration of the applied waters. The first and last mentioned management practices, however, may increase salt loading in percolating waters. If sub-soil permeability is limiting, the surface treatments mentioned above may or may not have influence. If internal drainage is a problem, prolonged and continued applications of water will create water-logged conditions, and perhaps a perched water table. Application rates considered appropriate to those sites which meet the site evaluation criteria listed in Table 16-3 are presented in Table 16-4.

In areas with moderately porous to very porous soils, the concept of areal mass emission rates can be used to indicate where localized degradation of groundwater may occur. Utilizing the expected effluent quality of the various treatment levels and the expected flow/rate from point sources, the mass emission rates of various constituents being discharged can be determined. Utilizing the unit land requirements mentioned earlier, the areal mass emission rates of various discharges can be calculated. Areal mass emission rates could be expressed in pounds of constituent applied to one acre of land per year. The areal mass emission rates from municipal wastewater discharges to the land can be compared to the areal mass emission rates of other waste producing activities, such as feed lots and irrigated agriculture.

Wastewater quality control schemes can effect significant reductions in areal mass emission rates. Rates from land application of municipal effluents approach the areal mass emission rates of irrigated agriculture. It is desirable that municipal wastewater quality control schemes will result in land application of wastewater of better mineral quality than the existing groundwater.

Source Control Considerations

Wastewaters are not all alike and their treatment requirements are obviously not all the same. Some wastewater streams are only lightly degraded and may be treated economically for reuse within an industrial site; other wastes are so toxic, caustic, acidic or highly mineralized that discharge to a community sewer must be prohibited by law. A good wastewater management program will recognize these differences, and will take advantage of the value and economy to be realized from water or waste reuse or, conversely, from pretreatment or isolation of problem wastes.

The source control approach has become mandatory in cases where cumulative nondegradable toxicants are present, since these must not be permitted in discharges to receiving waters. Probable regulatory agency action against offenders will stimulate treatment system managers to monitor and refuse entry of wastes containing such materials. Industrial wastes which disrupt or damage sewers or treatment systems are also subject to such sanctions unless pretreatment or other measures are employed to eliminate adverse effects. Wastes prohibited in most public sewers include gasoline and other flammable or explosive materials, corrosives, or other wastes of pH less than about 5.5, and solid or viscous substances capable of obstructing flow or interfering with equipment. Source control of toxicants has also become common to preserve the integrity of sludge digestion and other biological treatment processes. There are many other items which should not be discharged indiscriminately into community sewers, including substances which may harm either the sewers, treatment processes, or equipment, endanger personnel or property, cause conditions undesirable for disposal or reuse of wastewaters, or create a public nuisance. Judgment as to the acceptability of any such substance usually rests with the manager of the sewerage system but will be guided by regulatory agency requirements to an increasing extent.

The reasons for considering prohibition of various substances and improper discharge practices are obvious, but the accomplishment of source control is not always simple. This is particularly true for substances such as toxicants and biostimulants, the effects of which can upset treatment process operation and damage aquatic life in the receiving waters. Some consideration of the special problems of source control of toxicants is warranted in light of their importance and legal requirements of the Federal Water Pollution Control Act. Salt source controls are also discussed in light of particular needs of this basin.

Detection and source control of toxic materials discharged to sewer systems is one of the most difficult yet most pressing problems facing treatment system managers, and is of national concern. Section 307 of the Federal Water Pollution Control Act gives the EPA administrator broad powers to identify, restrict, and control the discharge of toxic chemicals. See Chapter 4. Provisions of other federal laws give EPA similar regulatory powers over the use of toxic emissions, and have greatly intensified the use of fish bioassay techniques for dischargers.

Reduction of toxicant emissions at the source will require cooperation from industrial operators having processes or control procedures which may contribute these substances. Some monitoring will be necessary, but the expense of a fool-proof sewer surveillance system designed to detect low concentrations or slugs of the many kinds of compounds considered toxic is likely to be prohibitive in most cases. A more practical approach would involve careful monitoring of the effluent chemical quality and determination of the cause of any toxicity changes that may occur from biossay results. Major contributors of substances considered to be toxic should also be required to monitor their discharges to the sewer system, particularly those which may have processes which produce pesticides or involve cumulative metals such as mercury or cadmium.

Source control efforts will be essential in some industries to comply with local waste ordinances. The effluents from treatment facilities will be judged by comparison to established discharge requirements. In effect, the treatment plant is the last line of defense, and toxic substances which may not be consistently removed or rendered harmless by the available treatment processes should be identified and controlled at their source. Continued discharge of toxic materials from wastewater systems can have a marked, even disastrous, effect on the receiving environment. This is pointed out dramatically by recent work of the Hopkins Marine Station in which pesticide (DDT, DDD, and DDE) concentrations in sand crab tissues were measured along the California coast from San Francisco to Ensenada, Mexico. By far the highest concentrations were measured in the vicinity of the large Los Angeles County outfalls at Whites Point. These high concentrations were some 50 times those measured near the Golden Gate. The biologist who conducted this work concluded that the majority of the pesticides found near the Los Angeles County outfall originated in the effluent from a large pesticide producer. Concern on the part of the company, the sewerage agency, and regulatory agencies led to a 90 percent reduction in pesticide discharges in early 1971, but effects of the accumulated toxicant on higher trophic levels of marine and shore dwellers will be evident for some time.

If the combination of source control and treatment fails to reduce toxicity to acceptable levels as measured by effluent chemical analysis, biossay or receiving water monitoring, enforcement sanctions will be applied. Treatment processes must be provided to insure a maximum level of protection but source control efforts should be directed toward reducing the toxicity load on the plant so the limits of the processes are not continually stressed.

As noted in Chapter 4, excessive concentrations of mineral salts in fresh water supplies can severely limit the usefulness of those supplies. Because future wastewater management programs in several areas of the basin may involve the direct reuse of reclaimed wastewaters and/or the recharge of groundwater basins, it is imperative that wastewater mineral quality be controlled. Since treatment to remove dissolved minerals is extremely expensive, it will become increasingly important that major sources of salts in excess of normal mineral increments be controlled at their source.

Sources of salts to municipal sewerage systems include the increment added by domestic use, brines from industrial processes, centralized and home zeolite water softener regeneration and boiler blowdown. The normal use of domestic water supplies in residences produces an increase in total dissolved solids ranging from 200 to 300 mg/l, exclusive of wastes from home regeneration household water softeners. In general, commercial uses produce a comparable increase, whereas changes attributable to industrial use are governed by the nature of the industrial operations. The extent of mineral pick-up in residences is usually related to the intensity of water use, as well as other habits of the community. Where water supply is conserved and costly, there is an incentive to limit per capita use and, thus, concentrate salts wasted to the sewer. On the other hand, in water-rich communities where water use is unmetered, a low domestic mineral increment can be expected.

Because most of the domestic water supplies in the southern Central Coastal Basin contain a substantial amount of hardness and because, with a few exceptions, centralized water softening has not been implemented, household water softeners are common. Household water softeners are ion-exchange units that exchange sodium ions for the ions that cause hardness, such as calcium, magnesium, and iron. These ion-exchange units are generally of two types: exchange canisters and home regenerated units. Exchange canister units are regularly regenerated centrally by commercial water softening firms. Home units are regenerated, usually automatically, at the residence by passing a concentrated brine solution through the unit. In both cases, the brines used to regenerate the units are discharged to municipal sewers. It is evident that for most communities surveyed, the regeneration of home water softeners and other commercial and industrial activities are causing a greater than normal increase of chemical constituents. Strict control of discharges of brines to municipal sewers could minimize that increase. The typical ion exchange home water softener is an over efficient device in that hardness is reduced from economically adverse or nuisance levels of perhaps 300 mg/l down to negligible concentrations approaching zero mg/l total hardness. Most people find water of 75-100 mg/l total hardness acceptable for home use. There are no health implications from excessive hardness. Although the water supply and wastewater treatment and disposal functions are usually separated institutionally, they are obviously related. The relationship is even more apparent in the Central Coastal Basin in situations where water supplies are drawn from and wastewaters are discharged to the same groundwater basin. In such situations, the line between wastewater treatment and water treatment is blurred.

A second reason for considering water supply and treatment in this study is to encourage cost-effectiveness in the basin water quality control plan. The control of mineral degradation of some of the groundwater supplies in the basin may require that the mineral (salt) content of municipal wastewaters be lower than at present. There are several processes available which can be used to lower the mineral content of wastewaters and raw water supplies. In some cases, it may be more cost-effective to partially demineralize or soften a water supply prior to its use rather than after its use. In this way, the benefits of water quality control can be accrued directly by those paying the control costs.

The processes generally used in water softening are limited to the lime-soda method and ion-exchange. The lime-soda process cannot reduce hardness to zero. When properly operated, however, hardness can be reduced to 50 mg/l as $CaCo_3$. Advantages of the lime-soda softening are that the total mineral content of the water is reduced, pH is elevated, which aids in corrosion control, and coagulation of water is more efficient. Furthermore, bacterial reduction can be increased and iron and manganese are removed. A major disadvantage is the large amount of sludge produced and high operation costs.

The ion-exchange methodology includes sodium cycle, split stream and demineralization. Most softening installations use the sodium cycle operation, which consists of passing hard water through a bed of an ion exchanger. Calcium and magnesium ions are removed from solution and replaced in solution by sodium. Hardness can be reduced to zero by this method. Brine disposal is a major problem created by ion-exchange softening, typical brines being in the range of ocean water salinities. Disposal methods vary widely, and include evaporation, dilution and deep-well disposal.

In Table 16-5, the Santa Maria Valley is used as an example of how lime-soda water softening plus a strict salt source control program could be used to control water and wastewater mineral quality. A comparison of the sodium, chloride and hardness content of the water supplies to that of treated wastewaters currently being discharged to the land in the valley suggests that in many instances home ion-exchange water softeners are being used to soften the municipal water supplies. The data indicate that the brines used to regenerate these home softeners are being discharged to the municipal sewerage system. Since these brines are not removed by conventional wastewater treatment, the salts pass through the wastewater treatment plant and percolate into the groundwater supply, aggravating the adverse salt balance which the basin is experiencing. A strict source control program which might involve phasing out home regenerated-ion-exchange water softeners could result in a significant improvement in wastewater quality. With lime-soda softening, however, the quality of water supplied to the consumer as well as wastewater quality could be improved drastically. The salts (calcium and magnesium compounds) removed from the wastewater as sludge would necessarily have to be exported from the basin or placed in a Class I landfill. Thus, with proper management of water supply and wastewater treatment, the municipal point sources of salt to the Santa Maria groundwater basin, for example, could be eliminated with much of the benefit of such a program accruing to those who are paying for it.

EVALUATION CRITERIA AND PROCEDURES

The various alternative water quality control plans are developed principally to meet water quality objectives and protect beneficial water uses. Evaluation of these alternatives is an essential step in the decision-making process. The evaluation process involves economic and less

Table 16-5. Control of Municipal Wastewater Mineral Quality

Service area	Anticipated mineral quality, mg/l											
	Current situation[f]				Source control only				Lime-soda water softening plus source control[g]			
	TDS	Sodium	Chloride	Total hardness[a]	TDS	Sodium	Chloride	Total hardness	TDS	Sodium	Chloride	Total hardness
City of Santa Maria												
Water supply[b]	830	60(22)[e]	30	450	830	60(22)[e]	30	450	440	105(70)[e]	45	100
Use increment[c]	590	190	230	d	300	70	75	135	300	70	75	135
Wastewater	1,420	250(d)	260	d	1,130	130(32)	105	585	740	175(62)	120	235
Santa Maria Public Airport												
Water supply	740	50(21)	45	445	740	50(58)	45	445	440	105(70)	45	100
Use increment	105	120	190	-170	300	70	75	135	300	70	75	135
Wastewater	845	170(58)	235	275	1,040	120(32)	120	580	740	174(62)	120	235
Laguna County Sanitation District												
Water supply	620	50(25)	50	350	620	50(25)	50	350	440	105(70)	45	100
Use increment	660	220	290	10	300	70	75	135	300	70	75	135
Wastewater	1,280	270(d)	340	360	920	120(36)	125	485	740	175(62)	120	235
City of Guadalupe												
Water supply	900	50(20)	50	525	900	50(20)	50	525	440	105(70)	45	100
Use increment	500	160	170	95	300	70	75	135	300	70	75	135
Wastewater	1,400	210(42)	220	620	1,200	120(32)	125	660	740	175(62)	120	235

[a] Expressed as $CaCo_3$

[b] Quality of water supplied to consumer

[c] Incremental increase in mineral concentration during use

[d] Data not available

[e] Percent sodium

[f] Data based on a very small number of samples.

[g] Quality of softened water supplied to consumer based on calculated values utilizing a Caldwell-Lawrence diagram with raw water similar to that currently extracted in the vicinity of the Santa Maria Public Airport.

Table 16-6. Cost of San Lorenzo Valley Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Secondary treatment with land disposal facilities at each waste source	3,041	937	207	452	9,459
IIA	Consolidate all flows at Scotts Valley and provide secondary treatment with land disposal	7,643	1,566	170	318	13,662
IIB	Consolidate all flows at Scotts Valley and provide tertiary (Level 8) treatment with discharge to Carbonero Creek	10,561	3,716	405	894	25,316
IIIA	Consolidate all flows at Felton and provide secondary treatment with land disposal	6,876	1,566	128	276	12,254
IIIB	Consolidate all flows at Felton and provide tertiary (Level 8) treatment with discharge to the San Lorenzo River	9,674	3,716	343	851	23,765

tangible aspects. In fact, if only economic factors are considered, a choice among alternatives becomes quite straightforward once numerical values have been assigned to each plan. However, many important criteria, such as reliability of a system or the sensitivity of the environment to a particular course of action, are not suited to mathematical treatment. Consequently, it is necessary to present and discuss economic, environmental and functional factors separately and weigh each factor in the final evaluation. The approach applies particularly to municipal wastewater facility plans; control procedures for nonpoint sources of pollution such as agricultural activities and urban drainage are accomplished more by non structural measures. Industrial controls are more subject to market forces.

These factors and their use in evaluating the plans were developed and modified during the course of the study as a result of the input received at public hearings regarding the alternative plans and from meetings held with local citizens and representatives of municipal wastewater agencies. Some of the factors evaluated under each category are:

Economic Evaluation

Capital cost
Total Annual cost
Present worth
Financial feasibility
Availability of grant funds

Environmental Evaluation

Invertebrate fishery
Fin fishery
Wildlife habitat
Endangered species
Archeological sites
Recreational use
Physical characteristics

Functional Evaluation

Effectiveness
Reliability
Flexibility
Implementation
Reclamation potential
Compatibility with
regional planning

A rigorous economic evaluation of many combinations of wastewater facility arrangements involving different metropolitan centers was used in the AMBAG area but was not attempted in the southern portion of the basin. Geographic factors weigh against this approach. The southern area is characterized by a small number of population centers in each of six designated sub-basins. Consequently, the number of alternatives to be considered for a given area could be reduced to a more workable number of options which would each be evaluated in terms of economic, environmental and functional factors. Quality-use-benefit concepts were included in the analysis of functional factors under the category of wastewater reclamation. The significance of each factor and its importance in the planning effort is discussed in the following sections.

Economic Evaluation

Project cost comparisons are made using established methods that are straightforward in their application. Estimated costs are developed for each of the alternatives described later in this Chapter. The evaluation involves separate considerations of different areas and combinations of some population centers where geographically permitted. Costs for the various alternative municipal facility plans are described later in this Chapter. Implications of various controls to be placed on diffuse sources of pollution are also discussed in more qualitative terms. Most of the following costs are based upon the standard cost estimation curves and other guidelines developed by the Basin Contractors in cooperation with OTC and approved for use by the OTC and the staff of the State Water Resources Control Board. This procedure is designed to place all cost estimates throughout the various basins on the same base.

Design criteria and cost data presented in this chapter apply to preliminary design or layout of major facilities. In layouts of this type, detailed construction drawings and specifications are not prepared. Instead, it is necessary only that a reasonably close approximation of the size, location, type of construction, route and cost of the various facilities be developed, and that this information be given in sufficient detail to permit comparisons between alternative plans. Obviously, some relocation and resizing of facilities will be required at a later date as a result of the detailed engineering study which is made during the preparation of drawings and specifications.

An effort has been made to assess the capacity and condition of existing major facilities with a view to their incorporation in the final recommended program. However, subregional facilities are considered on the basis of major drainage areas of watersheds, and this work does not include consideration of existing collection systems or feeder trunks serving limited topographic areas. Major trunk and interceptor sewers have been analyzed with respect to their adequacy for present and future needs when adequate information was available. Wherever their use is feasible, existing major pumping stations are incorporated into the recommended plans. Existing treatment plants have been retained in the layout of alternative plans when their use is compatible with required treatment functions and is economically justified.

The various components of the wastewater systems considered in this report have been laid out to serve the level of development anticipated in the service area in 2000. While some components of the alternative projects have been laid out to meet the needs of complete development, it does not follow that all improvements need to be constructed in the immediate future; in most cases, improvements can be effectively staged to meet demands as they develop. In the case of pumping stations and treatment plants, economy dictates that they be constructed so as to be readily enlarged. Influent structures, buildings, and principal conduits should be designed for long-term requirements, whereas mechanical equipment and additional treatment units may be installed at various stages of development.

Staging of construction of major works is influenced by many factors, including the applicable interest rate, expected growth pattern, financial problems, and the scale economies inherent in each type of facility. For example, trunk and interceptor sewers will be constructed in fewer stages than treatment works or pumping stations.

Capital Cost.

All capital cost data developed in this Chapter were based on a common price level (Engineering News Record construction cost index of 2000) which was expected to occur in 1973. In considering the estimates, it is important to realize that changes during final design will alter the totals to some degree and that future changes in the cost of material, labor, and equipment will certainly cause comparable changes in costs given herein. On the other hand, since the relative economy of alternative projects can be expected to change only slightly with an increase or decrease in general construction costs, decisions based on present comparisons should remain valid. The cost estimates include an allowance of 20% for the basic construction contingencies. This 20% contingency allowance is intended to reflect the costs associated with changes required during construction; contractor's interpretation of the OSHA requirements and his cost allowance therefore; his costs of compliance with the Affirmative Action requirements; uncertain bidding climates which may prevail during the years that the projects go to construction; etc.

Engineering, legal, and administrative costs are estimated as a lump sum cost equal to 35% of the construction cost obtained from the standard estimating curves. This percentage allowance is intended to reflect the cost of engineering contingencies (i.e., the uncertainties associated with the detailed design requirements at this level of planning). The allowance is also intended to cover the costs of the project level engineering studies and reports and of the preparation of final plans, specification and contract documents and of engineering services during construction including resident engineering and inspection during the construction period. The allowance, furthermore, is intended to cover the costs of foundation explorations required for final design; the preparation of O & M manuals, plant start-up services, the preparation of as-built drawings, etc.

Capital costs are expressed for the first stage of each plan, as well as for the total program extending throughout the study period to 2000. Hence, the capital cost tabulations include costs for systems of varying remaining service lives at the end of the study period. This apparent inconsistency is resolved in the computation of present worth.

Capital costs of projects do not include the value of existing facilities, even though useful facilities are assumed to be incorporated into the future programs. Where existing public works are abandoned, it is assumed that the owner-agency would be credited with the depreciated value of such facilities. From an area-wide viewpoint, the cost (value) of existing facilities would thus be included in all alternative plans. Consequently, the value approach is taken to simplify the calculations and presentation.

The capacity to be provided in each section of a trunk sewer or interceptor is based on the peak flow calculated for the area tributary to that section. For each area, this rate is the summation of peak municipal and industrial flows plus storm water flow, and is known as the peak wet weather flow (PWWF). However, in some cases alternative facilities are considered for handling a portion of the tributary peak wet weather flow. In general, trunk and interceptor sewers have been laid out to provide a minimum velocity of two feet per second when flowing full. All trunks are sized to carry their design peak flow while flowing full but without surcharge.

Interceptor conduits are laid out to facilitate interception of the major tributary flows, i.e., flows from local treatment plants, major trunks of local agencies, and large industrial flows. This does not mean that the proposed gravity-flow interceptors are capable of serving all tributary areas by gravity flow. For example, many existing local treatment plants have influent pumping facilities and most such pumping stations would be expected to remain in service. In such cases, however, additional lifts into the regional interceptors are avoided. For schemes involving use of pressure interceptors, new pumping stations would be required at most connections. Within the interceptor system, pumping stations are used to avoid excessive trench depths and tunnel lengths.

Capacities of existing trunk sewers and diameters of proposed trunk sewers were determined by means of Manning's pipe friction formula using a roughness co-efficient, "n", of 0.013. Trunks and interceptor conduits considered in this study are assumed to be of reinforced concrete. For diameters up to about 12 feet, precast pipe with rubber ring joints would be used; larger diameters would require cast-in-place construction in most cases.

Inverted siphons and force mains, unlike gravity sewers, always flow full. They must be designed with proper velocities to prevent the deposition of solids. It is necessary in some cases to use multiple lines. Large force mains and inverted siphons are normally constructed of concrete pipe or concrete lined and coated steel pipe. The most suitable layout and material for a specific installation must be determined during final design. Diameters of inverted siphons and force mains were calcualted by means of the Hazen-Williams formula, using a coefficient of roughness of 120.

Submarine outfalls, except as otherwise noted, are designed to carry year 2000 peak wet weather flow. Multiple port diffusers are used to maximize initial dilution of the sewage effluent with receiving waters. Submarine outfalls are generally constructed of cast-iron, reinforced concrete, or lined and coated steel pipe. Specific details of anchorage, or construction methods require extensive investigation of local conditions, which is beyond the scope of this report. Design criteria for the length and location of ocean outfalls and diffusers are contained in the ocean disposal section of this chapter.

Pumping stations are designed to handle peak wet weather flow from their tributary areas except in those cases where alternative means are considered for mitigating peak rates. Hydraulic design capacity of pumping stations will, of course, be compatible with the capacity and staging of associated trunks and interceptors. Although pumping units may be installed incrementally as required by growing demand, structures will be designed for year 2000 development or for the capacity of adjacent interceptors.

When pumping stations are constructed as an integral part of a wastewater treatment plant, costs are lower than for a separate station because their construction is concurrent with a larger project, items of equipment are common to both treatment plant and pumping station, and space requirements are less. Costs of influent pumping stations are included in treatment plant costs.

Primary considerations in the design of a wastewater treatment plant are the required capacity and treatment processes. Plant capacity is usually expressed in terms of average dry weather flow. The proper degree of treatment to be provided is based on analyses of waste strength and capacity of the receiving water system. A plant must be designed with sufficient capacity to handle peak organic as well as peak hydraulic loads and must be planned for enlargement to handle future increases. All plant layouts provide for handling peak wet weather flows unless infiltration-inflow is controlled or specifically provided for in other facilities.

Treatment plants are laid out to provide flexibility in operation and control. Protection against complete plant shutdown is provided by bypasses around each major unit and, insofar as practicable, multiple process units are provided. Their design also includes adequate illumination and ventilation, convenient means for drainage of plant units, provisions for health and safety of personnel and for accessibility to and ease of operation and maintenance of gates, control valves, and other operating devices. Adequate measurement, sampling, laboratory, and maintenance facilities, alarm devices, data logging and automated controls are included to the extent required for a high degree of reliability of operation and as justified by reduction in operating costs. Standby power units are included for emergency operation of all essential components. Provision is made for odor prevention and control, both in basic design and, as necessary, through special structures and equipment for that purpose. Special attention is given to appearance through architectural design of basic layout, buildings and process structures, and landscaping, and appropriate allowances are made for the cost of these important features.

Treatment plant costs are based on initial construction of units to accommodate a given, average dry weather flow with provision for enlargement to twice that flow. Initial construction provides for construction of inlet structures and channels, major pipelines, control and service facilities, and other basic units of a size adequate for the expanded capacity. Enlargement costs provide for additional process units necessary to achieve the desired increase in capacity. Enlargement costs for increasing plant capacity up to double its original capacity are estimated to be 20 percent less than the cost obtained for the given flow. That is, to enlarge a plant from 100 to 150 mgd, the cost is estimated for a 50 mgd plant less 20 percent. Subsequent enlargements (i.e., beyond twice the initial capacity) are estimated to cost 10 percent less than the cost of an original plant of that capacity. Costs were developed from cost estimating curves approved by the OTC and the State for all treatment processes considered in this report.

The costs for solids processing are based on the nature and quantity of solids to be processed; differing amounts and characteristics of solids will be produced by the various wastewater treatment processes considered. Costs for solids processing plants are based on on-site disposal of residue. Where disposal must be off-site, disposal costs are to be estimated separately. Unlike wastewater treatment works, facilities for solids treatment are usually constructed for the initial loading condition only. Enlargement costs can, therefore, be expected to be about the same as the original construction cost.

Storage ponds may be required to hold the effluent during periods when rainfall prevents land disposal of treated wastewater. For Central Coastal Basin conditions, storage to accommodate seasonal spray irrigation amounts to about one-third of the annual wastewater volume. This storage volume provides for periods of reduced land application rates as well as periods when no discharge can occur. Costs are based on 15 feet deep ponds where convenient storage reservoirs cannot be constructed using dams. Dikes for the ponds would be provided with 5-feet of free board, a top width of 10-feet and 2:1 side slopes. Riprap would be provided for slope protection and sides of ponds would be sealed to prevent seepage where necessary. Earth work is assumed to be primarily cut and fill. Storage pond construction costs are calculated using about $45 per linear foot of dike around the pond.

Percolation basins are sized using the unit land requirements presented earlier. Fifteen foot high dikes are assumed and construction costs are calculated using about $20 per linear foot of dike around the basin with two transverse dikes to divide the basin into four segments for maintenance purposes.

Spray irrigation areas are sized using the unit land requirements presented earlier. Spray irrigation facility costs are assumed to be $750 per acre for areas of less than 30 percent slope and $1,500 per acre for the construction of systems on rougher terrain.

The cost of land for disposal areas has been included in construction cost estimates. Land costs were obtained from county assessors and vary greatly over the study area.

Total Annual Costs

Total annual costs represent the sum of operating costs and the annual cost of capital. The total annual cost of each plan is used as a simple expression of the true economic burden of each alternative scheme. Annual costs are computed for each project and each major stage of construction. Annual cost data are summarized for several time periods. Within each period, the figures given are the average annual costs for that period. For consistency, the same price level is used for annual costs and construction costs—that is, an Engineering News-Record Construction Cost Index of 2000. This index value represents prices expected to occur in mid-1973.

Interest rates, generally used as a compounded percentage per annum, are an expression of the time value of money. Interest rates must be assumed for purposes of computing the annual cost of capital, for estimating the total cost of prospective bond issues, and for discounting the value of deferred works in present worth comparisons.

Many studies for public works programs have used very low discount rates, based on the apparent interest costs of high grade, tax exempt bonds. This practice ignores the fact that public projects are financially supported by consumers and corporations for whom the time value of money is much higher than public bond interest rates. Also, interest rates for public financing are now at relatively high levels; a recent major sale of California general obligation bonds had a net discount rate of 5.37 percent. The Federal Water Resources Council recently established a discount rate of 6.875 percent for evaluation of all federal water resources projects, while the Federal Office of Management and Budget calls for a rate of 7.0 percent. An interest rate of 6.0 percent is used in this study for evaluation of all projects.

Even though most bonds sold for water quality projects will have redemption periods of 20 or 25 years, an estimate of the average useful life (economic life) of each project is used in computing the annual cost of capital. This annual fixed cost is computed by applying a capital recovery factor, available from standard interest tables, to the project capital cost. This is approximately the same as straight line annual depreciation plus average annual interst cost over the economic life of the project.

The economic life of all sewers, siphons, force mains, tunnels and outfalls has been taken as 60 years. Pumping stations and treatment plants were assigned a life of 30 years to take into account the replacement of mechanical equipment and other plant improvements which will occur prior to the full depreciation of structures. Replacement of mechanical equipment is assumed to be due only to obsolescence, inadequacy, or major deterioration. The cost of repair and minor replacement is included under operation and maintenance. The economic life assigned the various units is for cost comparison purposes and does not necessarily reflect the true useful lives of major facilities. There are many trunk sewers in service which are over 60 years old and some have been in service more than 100 years. Treatment plant and pumping structures can be expected to have useful lives well in excess of 30 years.

Annual operation and maintenance costs of conveyance facilities such as intercepting sewers, force mains, tunnels, and ocean outfalls will be taken at a flat 0.05% of the estimated construction cost with no differentiation between pipe line materials except as reflected in the construction cost.

Land sites and right-of-way are assumed not to depreciate or change in real value. Therefore, the annual fixed cost of land is simply the land value multiplied by the appropriate interest rate.

Maintenance and operating costs for pumping stations are the sum of (1) power costs for pumped flows at the required pumping head, and (2) other costs which are related to the peak flow which the station is designed to accommodate. The operation and maintenance costs include allowances for labor, supplies, administration, replacement parts and repair necessary to keep pumping and other mechanical units in effective operating condition.

Operation and maintenance costs for treatment facilities are based on average dry weather flow and have been derived from operating reports of numerous agencies and from published data. These costs assume first-class operation and include costs for labor, power, chemicals, supplies replacement parts, repairs, administration, effluent monitoring and laboratory control.

Solids processing operation and maintenance costs are based on the average number of pounds of dry solids to be processed. They include labor, power, chemicals, supplemental fuel, supplies, replacement parts (excluding major equipment replacement which is covered under depreciation), repairs, administration and laboratory control. Costs include on-site disposal of sludge or ash. If other means of disposal are required, the cost is estimated separately.

Present Worth

In order to account for the reduced present value of deferred construction, and to compensate for varying project lives, present worth is computed for various program phases and for all costs incurred between 1976 and 2000. Stated simply, the present worth of a program is the amount of money that would have to be provided initially to meet all the financial needs of the program, including operating costs, as they occur from year to year. Present worth is computed as the present worth of the series of total annual costs. This method of calculation gives a more realistic expression of the present worth of capital expenditures than the alternative approach of computing present worth of lump sum capital costs as such investments occur. For a facility whose useful life extends beyond 2000, present worth of the capital value is taken as present worth of the series of annual capital costs to the year 2000.

Financial Feasibility

Future water quality management will involve much greater capital and operating costs than have the ongoing wastewater programs. The financial burden is going to increase rapidly during the next several years, and the ability to support the local financial burden is one of the important problems to be considered in present planning.

The problem of project financial burden is considered two ways in this study. Later in this chapter, the cost tabulations for the first stage construction of each alternative project include an estimate of the initial local annual financial burden, which is a reasonably accurate indication of the local cash requirement of the project. The local financial burden is based on the assumption of 87.5 percent federal and state grant funding with the remaining 12.5 percent (local share) of the capital cost obtained by sale of 25-year bonds at 6 percent interest plus the annual operating cost in the first full year of project operation. This approximates a situation in which the bond redemption schedule reaches its maximum rate at the time the project is fully developed and in normal operation. As a practical matter, most bond redemption schedules reach a maximum rate five to ten years after the bond sales.

In Chapter 5, the implementation program for the recommended water quality management plan is presented, and a cash flow analysis is used to show financial requirements in the early years of the program. In that case, costs are all given on an adjusted basis, reflecting the rates of price escalation. This format is also used to provide data for an analysis of user costs and charges.

Availability of Grant Funds

Current federal and state construction grant programs were mentioned in Chapters 9 and 10; the extent of eligibility for construction grant funds of the projects developed is considered in this chapter. The amount of expected grants is taken into account, in expressing the estimated local financial burden of the alternative plans. Although facilities may be eligible under the law, priority systems may preclude funding, depending on appropriations. Consistent with management memoranda from the State Water Resources Control Board, it is assumed that state grant funds will be available for those projects scheduled to commence through 1980. Accordingly, grant amounts are taken as 87.5 percent representing grants of 75 percent as provided in the federal water quality control legislation passed by the Congress in October 1972, plus an additional 12.5 percent of state funds.

Grant funds are currently eligible for new collection systems in unsewered communities and for certain major sewer rehabilitation projects under Section 211 of the Federal Water Pollution Control Act. Land which is directly involved in the treatment process is also technically eligible, as are interceptor sewers. Priority systems developed by the state will determine fund availability; currently new collection systems for areas with documented public hazards are receiving high priority. Ocean disposal projects involving upgrading of treatment from primary to secondary treatment are expected to receive lower priority than inland improvement unless special circumstances warrant high priority.

No grant funds are available for improvements to improve water quality under present legislation. There are cases where more cost-effective and environmentally sound water quality management should begin with the water supply rather than be applied to wastewater. This is particularly evident in certain inland areas reliant on highly mineralized groundwater supplies. A need for legislation to permit grant funding for selected water treatment processes such as municipal well water softening or demineralization should be considered for use in such cases. A further discussion of this problem is provided elsewhere for the Santa Maria Valley area alternatives.

Functional Factors

Alternative plans are also compared on a functional basis by considering issues which include operational and institutional factors such as those listed below. Evaluation of these less tangible aspects of alternative plans requires considerable judgment. The approach that has been used involves posing questions related to each factor and determining how each plan rates in terms of questions posed. This approach involves obtaining opinions of a number of informed people preferably representing diverse interests.

Effectiveness

Protection of surface waters for beneficial uses.
Protection of groundwaters.
Relation of expected performance to cost of the project.

Reliability

Assurance that project performance will equal expectations.
Possible system failures due to natural disasters or catastrophies will have acceptable consequences.
Mechanical and process failures will be infrequent and the consequences of such failures will be minimal.
Energy and other resource shortages effects.

Flexibility

Sensitivity of program cost and performance to changing patterns of urban development.
Adaptability to technological advances.
Adaptability to meet future water quality requirements.

Implementation

Plan can be implemented rapidly from an institutional and construction standpoint.
Plan can be expected to encounter minimum legislative, financial and logistical obstacles.
Plan appears likely to receive public and local governmental acceptance and support.

Reclamation Potential

Plan encourages wastewater reclamation and reuse.
Plan satisfies higher quality reclaimed water markets.
Plan provides for improved allocation of water resources.

Compatibility with Regional Planning

Compatibility with existing water and wastewater programs. Minimum conflict with recommendations of other subregional studies. Compliance with interim water quality control plans. Consistency with established regulatory agency policies. Compatibility with environmental plans.

The analysis of intangible functional factors is displayed in matrix form wherein the scoring of each plan is compared according to factors rated. Plan selection is then based on the relative rating of tangible and intangible factors such as these and those involved in the environmental evaluation.

Relative to flexibility, alternative courses of action which are discussed in this chapter are developed to a level of refinement that allows the greatest ability of each alternative to cope with development which may take place at a rate different from the "base case". Consideration was made of sensitivity of each alternative to the rate of development. Adoption of any particular plan would not necessarily imply adoption of the base case as a recommended goal for development.

Flexibility is provided in many plans where selection of a recommended plan is not obvious; for example, many plans provide for several options relative to disposal methods. These options can be evaluated in more detail in project level studies; however, for purposes of Basin planning, either option is acceptable as a means of water quality control. Levels of consolidation are generally established in the recommended plans, although future options are preserved in several cases by staging of implementation programs. Similarly, the level of treatment is subject to further feasibility study in some cases where treatment can be tailored to final decisions on disposal sites and on the obtaining of additional water quality data or information on non-point source effects. The extent of sewering of some septic tank areas is subject to feasibility studies which include septic tank management considerations, particularly in more sparsely settled areas; the final extent of sewering could determine the extent that consolidation is feasible. Accordingly, flexibility is emphasized in the functional evaluations and where possible options are provided in the recommended plans themselves; however, it should be stressed that each option must be environmentally acceptable in the long-term or viewed only as a short-term option pending added data gathering to determine total environmental effectiveness of alternatives as part of the Project Report under a 201 facility planning effort or under a 208 areawide waste management plan.

Screening Procedure

A large number of alternative waste treatment configurations were formulated for each subregion within the Central Coastal Basin. The number of alternatives depended largely on how many waste load sources were contained within the subregion and the possible interconnections of those waste sources. The criteria just described were used in a two phase evaluation procedure. First, a preliminary screening of the alternatives was performed by making certain environmental and economic evaluations. After the preliminary screening, a more rigorous evaluation was made of the remaining alternatives bringing all of the criteria into the evaluation.

Basically there are four wastewater management strategies available—land disposal, ocean disposal, stream disposal and reclamation and reuse. Within each subregion, the preliminary screening eliminated a number of alternatives within each of the four categories. Alternatives involving land disposal were compared to land disposal sensitivity maps which show the relative sensitivity of land areas to waste discharges. These were developed by delineating areas unsuitable for land disposal including the following factors:

steep slopes
low soil permeability
urban areas
flood plains
parks and wildlife refuges
high groundwater tables

Alternatives involving ocean and stream disposal were compared to sensitivity maps which show the relative sensitivity of water areas to waste discharges. These were developed by delineating areas unsuitable for ocean and freshwater disposal including:

poor circulation
areas of high nutrient buildup
habitats of rare or endangered species
kelp beds
spawning areas
important commercial and sport fishery areas

Alternatives involving wastewater reclamation and reuse were compared to the projected needs of beneficial uses that could be served by such alternatives and the availability of alternative water supplies.

Further screening was accomplished by examination of the costs of the alternatives. Many waste loads are small and are great distances from the next waste load. Consequently, within each of the broad management strategies, it was possible to screen alternatives involving the consolidation of waste loads on the basis of cost.

The second phase of the evaluation brought all of the elements of the criteria into play. In the case of the Monterey Bay area, for example, the Bay-Ecologic and Plume Models were used to evaluate the response of the bay to selected ocean discharge alternatives and the groundwater model was used to determine the change in groundwater quality affected by selected reclamation and reuse alternatives. Then benefits were calculated for reclamation plans for comparison to the additional costs of providing high quality effluent. Finally, the functional factors were considered in completing the evaluation of the alternative wastewater management strategies.

SANTA CRUZ COASTAL SUB-BASIN

The Santa Cruz Coastal Sub-basin includes only three municipal waste discharges. Those of Davenport Sewer Maintenance District, Ben Lomond Conservation Camp and Big Basin State Park. Due to the distances between each of these facilities and the small quantities of wastewater to be treated, the costs of consolidating these flows greatly exceeds the costs of maintaining separate treatment and disposal facilities.

The Davenport Sewer Maintenance District operates an Imhoff tank which provides primary wastewater treatment for the residents of Davenport. The design capacity is rated at 25,000 gallons per day. The average flow of 20,000 gallons per day is discharged through a cliff tunnel into the surf at an inaccessible beach area. Although the discharge meets waste discharge requirements, the discharge to the surf should be eliminated.

The "Newtown" area, located near Davenport, is currently sewered. All wastes flow to a septic tank for treatment. It is believed that the septic tank discharges to an irrigation ditch. No further information is available about this system since it is not currently maintained.

An extended aeration package treatment plant is scheduled to be constructed by the Davenport Sewer Maintenance District in 1977-78 to provide for increased flow due to normal growth and the addition of the "Newtown" area to the treatment system.

The Ben Lomond Conservation Facility, a camp operated jointly by the Division of Forestry and the California Youth Authority, provides a primary treatment facility rated at 12,000 gallons per day capacity. The average flow of 6,000 gallons per day currently passes through a septic tank and is then discharged to oxidation ponds. The option of spray irrigation also exists in the event of increased average flows.

Big Basin State Park operates a trickling filter treatment facility followed by sand filtration with a design capacity of 120,000 gallons per day. The plant serves the campgrounds in the southern portion of the park and discharges an average of 35,000 gallons per day to Waddell Creek. This discharge is not currently in compliance with waste discharge requirements. The discharge is scheduled to be removed from Waddell Creek during 1972-73. A spray irrigation system will replace the present method of discharge.

The potential for wastewater reclamation and reuse is very limited in the North Coastal Region. There are no major irrigated agricultural areas and water supplies are adequate compared to the projected water requirements.

After screening consolidation and reclamation possibilities it was concluded that the only viable alternative for the North Coastal Region involves the maintenance of secondary treatment plants and land disposal facilities at each of the three existing municipal discharger locations.

There may be a problem in financing a project for Davenport which would require an annual local charge of $456/connection. A possible solution to this financial feasibility problem could be obtained through recognition of the present practices at Davenport as meeting the spirit of the plan objectives since no impairment of beneficial uses can be attributed to the present discharge. A second possible approach could be to encourage oxidation pond use in lieu of conventional secondary treatment. Regardless of approach the Davenport situation should be viewed as a low priority item.

SAN LORENZO RIVER SUB-BASIN

The San Lorenzo Sub-basin is considered in two parts, the inland valley area and the coastal area. The Coastal area is discussed together with the Aptos-Soquel Creeks Sub-basin since facilities in these two areas are likely to be consolidated. Greater consolidation involving the San Lorenzo Valley and the Watsonville area are also considered.

San Lorenzo River Sub-Basin — Inland Region

Almost 200 alternatives, each of which makes provisions for treatment and disposal of waste loads generated in the inland San Lorenzo Valley, Bear Creek Estates, Big Basin Woods, Boulder Creek, Ben Lomond, Felton-Mount Herman, Zayante and Scotts Valley planning areas, were identified. The alternatives range from providing treatment and disposal facilities within each planning area to total consolidation of the flows from these areas and a common treatment and disposal facility. In some cases septic management may be workable as an interim measure in lieu of extensive sewering.

Large areas suitable for land disposal in the valley are scarce, primarily due to steep slopes and low permeability of soils. However, it is believed that areas of sufficient size could be found to accommodate the projected flows at each of the waste sources. The largest flow, 0.7 mgd in 1985, is projected for Ben Lomond.

The San Lorenzo Valley County Water District operates a 30,000 gallon per day extended aeration package plant which provides secondary treatment for flows from Bear Creek Estates subdivision. The average flow of 10,000 gallons per day of treated effluent is sprayed on a restricted area of the surrounding hills. The treatment system is approximately ten years old. The spray disposal system is scheduled for expansion.

The Big Basin Water Company operates an extended aeration treatment facility which serves the Big Basin Woods Subdivision. The treatment facility which is rated at 35,000 gpd, provides a secondary level of treatment. Effluent is disposed of in a subsurface leach field. The treatment plant was constructed in 1965 and has been maintained in good condition. The effluent meets current discharge requirements. The plant can adequately meet the near future needs of the service area.

The County of Santa Cruz will put into operation a 200,000 gpd extended aeration treatment facility to serve the Boulder Creek Country Club area in mid-1973. Effluent will be disposed of by golf course irrigation. Waste flows from the service area were previously treated at Big Basin Woods subdivision.

The City of Scotts Valley operates an extended aeration package treatment plant designed for 100,000 gallons per day. The average flow, which has reached the design capacity of the plant, is discharged into a subsurface leaching system. However, Scotts Valley has experienced severe failure of this subsurface absorption field during the past winter. An additional 300,000 gallons per day extended aeration treatment plant will be available beginning in 1974 to provide for additional projected flows. However, even with the addition of this treatment plant, Scotts Valley will not have the capacity to dispose of the future flows. Capital expenditures are currently being kept to a minimum while future alternatives are being examined. These alternatives include a reclamation plan in conjunction with the Felton-Mount Herman areas or a trunk line to the City of Santa Cruz for treatment and disposal.

Several developed areas within this sub-basin are not presently sewered. The areas of Forest Spring, Redwood Grove, San Lorenzo Park and Wildwood all use individual disposal systems for wastewater disposal. In the past, failure of individual disposal systems has occurred in each of these areas. There are no existing plans for the collection and treatment of wastewater from these areas.

All domestic wastes in the Felton-Mount Herman planning area are disposed of by individual treatment systems (septic tanks). The past failure of individual systems is believed to have resulted in the degradation of surface waters in the area, according to the Central Coastal Regional Water Quality Control Board. The report further states that, due to topography geology and population density, this area is unsuitable for the use of septic tank systems. This area includes the communities of Felton-Mount Herman, Olympia and Mill Creek which have a combined population of 5,800.

There are no domestic or privately-owned industrial wastewater treatment facilities within the Ben Lomond planning area. All wastewater is currently disposed of in individual wastewater disposal systems. Some problems of effluent surfacing and surface water pollution have been identified with these systems. The Ben Lomond and Glen Arbor areas of the San Lorenzo River Valley have scheduled the construction of collection systems and a trunk line. Raw wastewater would then be pumped to Santa Cruz for treatment and disposal.

There are no existing domestic or industrial wastewater treatment systems within the Boulder Creek planning area. All wastewater is disposed of by individual systems. Problems of surface water pollution attributable to these systems have been identified. Construction of a collection system and a trunk line to Ben Lomond has been scheduled for the Boulder Creek and Brookdale areas of the San Lorenzo Valley. From Ben Lomond, the raw wastewater would go on to Santa Cruz for treatment and disposal.

Wastewater reclamation and reuse potentials in the San Lorenzo Valley are low. Use of reclaimed wastewater for recreational purposes is the major possibility. Since the watershed is already developed for domestic water supply, the use of reclaimed water for stream flow augmentation or for recreational lakes is questionable at this time from a public health standpoint though this possibility has merit and should receive future consideration in project reports. Consolidation of waste loads is accomplished most economically at the downstream end of the subregion. In view of this, it is logical to consider transporting all wastewaters generated in this region to Santa Cruz for treatment and disposal. This inter-regional alternative is discussed in a separate section, following discussion of the coastal region alternatives.

The alternatives were narrowed to three within the region; these are shown on Figure 16-4. Alternative I involves the retention of existing facilities at Bear Creek Estates, Big Basin Woods and Scotts Valley. Treatment would be upgraded where required and these facilities would be expanded to meet projected growth. New facilities would be constructed at the remaining waste load sources. Alternative II calls for consolidation of all flows near Scotts Valley. Two options for disposal of the treated wastewater were considered as part of this alternative. A secondary level of treatment could be provided with a land disposal facility. Also, a tertiary level of treatment could be provided with the treated water being used to augment the flow of Carbonero Creek. Alternative III would consolidate all waste loads generated in the region at Felton where two options appear most likely. A secondary level of treatment and land disposal could be provided, or a tertiary level of treatment could be provided with the treated water being used to augment the flows of the San Lorenzo River.

The costs of the alternatives are shown in Table 16-6. From a total cost standpoint, Alternative I appears to be considerably more attractive than inland region consolidation, Alternatives II and III. However, when federal and state construction grants are considered, the local cost of Alternative I is close to that of Alternative IIIA. The local

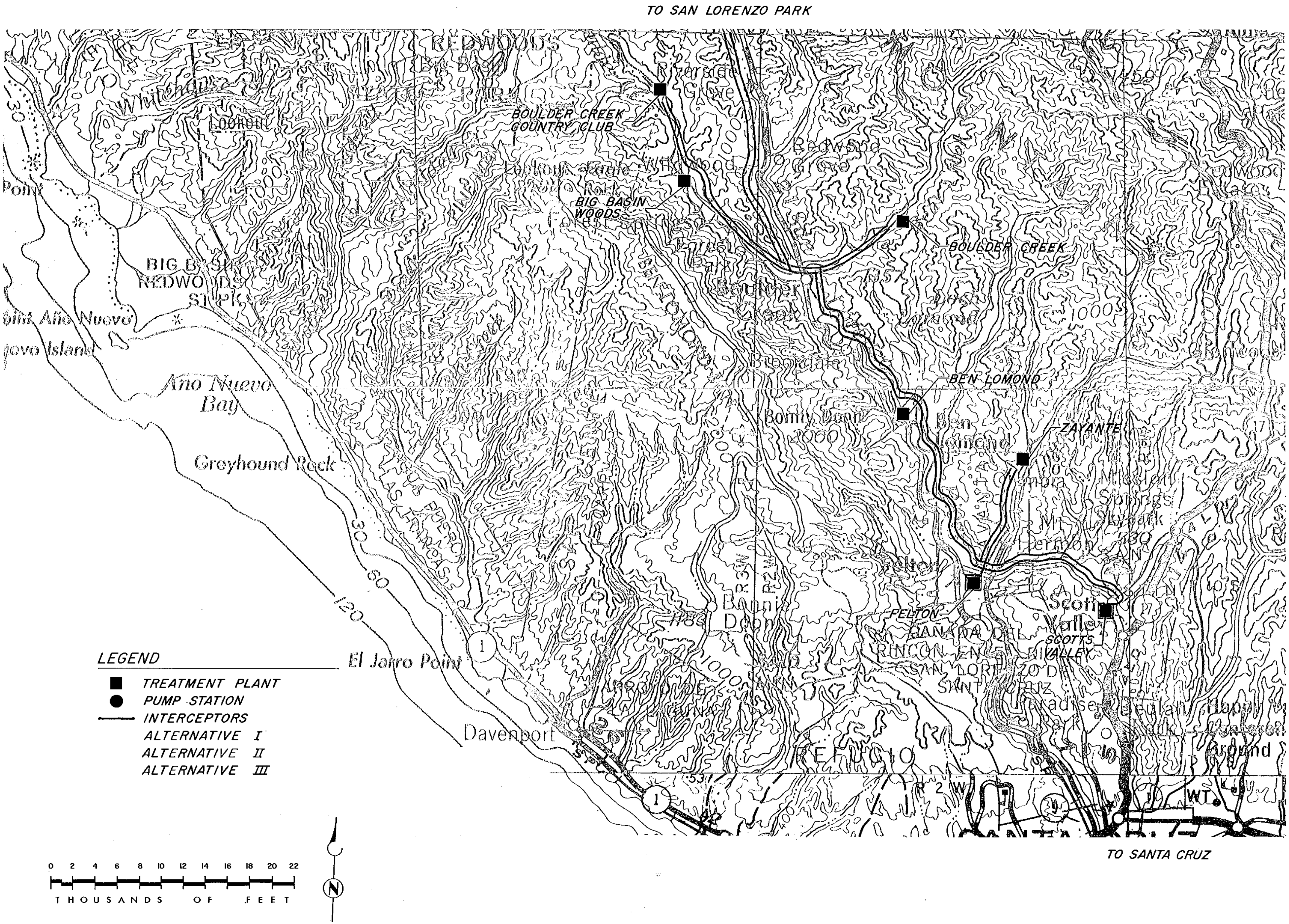


Fig. 16-4 San Lorenzo Valley Alternatives

equivalent annual costs of Alternative I and IIIA are $500,000/yr and $470,000/yr, respectively; or expressed as annual per capital local cost, the costs would be $22 and $20.

It would cost an additional $130 per acre-foot to produce treatment level VIII water compared to treatment level II water in Alternatives II and III. The estimated cost of developing additional surface water yield in the Santa Cruz area is $55 per acre-foot for yields equivalent to the amount of wastewater expected to be generated in the inland San Lorenzo Valley. A water supply master plan for Santa Cruz County calls for new surface water development beginning in 1975 with more development scheduled for about 1990. Wastewater reclamation would be a much more expensive method of augmenting stream flows than would surface water development. Reservoir projects could be formulated to include stream flow augmentation as well as water supply as project purposes.

San Lorenzo River Sub-Basin — Coastal Region

The City of Santa Cruz presently operates a primary treatment plant with a design capacity of 7.0 million gallons per day. This plant discharges an average of 5.5 to 6 million gallons per day into the ocean at a point 2,000 feet offshore and at a depth of 36 feet. The treatment facilities include a bar screen, comminutor, clarifiers, vacuator, separate sludge digestion and centrifuges. Two flow proportional V-notch chlorinators provide pre- and post-chlorination at dosage rates of 5 and 24 ppm, respectively.

Santa Cruz has a critical problem of storm water infiltration in the older sections of its collection system. Inflows to the treatment plant during intense rainstorms have occasionally reached three times the design capacity of the plant. Even at lesser flows the city is forced to bypass a portion of the influent to avoid overloading the primary clarifier.

Several industries located in the City of Santa Cruz dispose of their wastewater in the municipal sewer system. The major industrial wastewater producers include: A.K. Salz Tannery, Lipton Company, William Wrigley, Jr. Company, John Ingles Frozen Food Company and Stokely-Van Camp, Inc. Specific information on the characteristics of the wastes discharged by these industries is not available.

Although the City of Santa Cruz presently meets discharge requirements, the addition of a primary clarifier and additional sludge handling facilities which would increase the present capacity to 21.0 MGD are scheduled for construction to meet projected future flows. Construction of a new outfall off Lighthouse Point has been scheduled.

Rolling Woods subdivision provides a secondary treatment plant employing a redwood bark filter. The design capacity of this plant is rated at 11,000 gallons per day. The average flow of 6500 gallons per day is disposed of by subsurface leaching. However, severe failures have been experienced with this subsurface absorption field on several occasions. An interceptor to convey waste flows to the City of Santa Cruz for treatment and disposal is planned.

Facilities described above are considered with alternatives for the Aptos-Soquel Creeks and Pajaro River Sub-basins.

APTOS — SOQUEL CREEKS SUB-BASIN

The Aptos-Soquel Creeks Sub-basin includes municipal treatment facilities operated by the East Cliff County Sanitation District, the Aptos County Sanitation District and the Sand Dollar Beach development. Other communities in this sub-basin are served by individual systems.

The East Cliff County Sanitation District at present operates a primary treatment plant with a design capacity of 4.0 million gallons per day. This facility also handles all of the flow from the adjoining Capitola County Sanitation District. The combined average flow of 3.5 million gallons per day is discharged to Monterey Bay through a 300 foot outfall at a depth of five feet. The treatment facilities include a clarifier, comminutor, chlorine contact chamber, grit separator, sludge thickener, centrifuge and sludge incinerator.

The effluent from the East Cliff Sanitation District is considered to be of poor quality. Due to the periodical overloading of the plant, disinfection, although maintained, has been difficult. The discharge location is considered unsatisfactory due to recreational use in the beach area near the outfall. Prior to 1970 coliform concentrations often exceeded that considered acceptable for swimming, but the standards are now being met. The discharge is located just offshore from a heavily used beach area and extends into waters used extensively for swimming.

The East Cliff plant is located very close to private residences creating a potential problem of odors. The plant is attractively buffered by trees which eliminate visual aesthetic problems. Expansion of the plant at this site would not be possible due to limited land availability and would be undesirable due to the residential character of the neighborhood.

The Aptos County Sanitation District operates a primary wastewater treatment plant with a design capacity of 0.83 million gallons per day. The average flow of 0.8 million gallons per day is discharged to Monterey Bay through a 2000 foot outfall at a depth of 35 feet. Treatment facilities include clarifiers, comminutor, grit separator, chlorine contact tank and separate sludge digestors. Pre- and post-chlorination are provided by a flow proportional V-notch chlorinator.

The Aptos discharge is also located in waters used extensively for body contact sports, and bathing water standards have been consistently met in the receiving waters. Shellfishing standards in the waters are often violated during storm flows when disinfection is difficult; however, there have been no reports of contamination of the meat of shellfish taken from these waters.

The Aptos waste treatment plant like the others is located in a residential area. Expansion either in size or to provide an additional level of treatment would not be possible due to limited site area, and public nuisance problems could be critical if odors were created. The District plans to construct an interceptor to convey wastes to the City of Santa Cruz for treatment and disposal.

The Sand Dollar Beach development has an extended aeration package treatment plant with a rated capacity of 30,000 gallons per day.

There are no existing wastewater treatment facilities within the Soquel Uplands or in the La Selva Beach area. Individual disposal systems are used for wastewater disposal. No problems relative to water pollution have been identified with the individual disposal systems.

Sixteen alternatives, each of which provides for the treatment and disposal of waste loads generated in the North Santa Cruz, Santa Cruz, East Cliff, Aptos and La Selva Beach planning areas, were identified for the coastal area of the San Lorenzo Valley and Aptos - Soquel Subbasins. The alternatives range from providing separate treatment and disposal facilities for each area, to total consolidation of all flows generated within the region in a common treatment and disposal or wastewater reclamation facility.

Land disposal areas in the vicinity of most of the waste load sources are difficult to locate due to the highly developed nature of the region. Ocean disposal alternatives are equally limited, if the Regional Board's prohibition of discharge in Soquel Cove is honored. AMBAG oceanographic studies support the Board's prohibition of discharge. Wastewater reclamation and reuse potentials at any significant scale do not appear viable in the coastal region in the near future. Agricultural development is widely scattered and there are very few possibilities for recreation development through reclamation.

All alternatives appear to be about equal with respect to reliability, effectiveness, ease of implementation and compatibility with regional planning. The greatest potential for reuse of reclaimed wastewaters is in the lower Pajaro Valley area for irrigated agriculture. However, the immediate needs of the Pajaro Valley can be met by reclaiming the waste flows generated in the Watsonville area or by importing San Felipe water. In view of this, the most flexible plan would be to treat all wastewater generated in the coastal region at a single treatment plant and discharge it to the ocean at Santa Cruz until a need was demonstrated. If in the future, additional supplemental supplies are needed in the lower Pajaro Valley, flows from Santa Cruz could be transported to that area for reuse. If the need does not develop in the Pajaro area, the Santa Cruz plan would be either to continue with treatment and discharge to the ocean or to convert to reclamation and reuse in the San Lorenzo Valley watershed. Treatment equivalent to level II effluent would be discharged through an outfall into the ocean. Biological secondary treatment is required by the EPA by 1977; however the State Ocean policy requirements could be met by physical-chemical treatment. Planning for treatment plant upgrading should consider physical-chemical as a possible future option. At treatment level A-IV, the reclaimed water could be used in a recreation reservoir or for stream flow augmentation. The costs of the regional alternative for two treatment level options are shown in Table 16-7. Fig. 16-5 shows the location of facilities considered for the Santa Cruz Region.

INTERREGIONAL ALTERNATIVES

For the San Lorenzo River, and Soquel-Aptos

Table 16-7. Cost of Santa Cruz Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
IA	Consolidation of all flows at Santa Cruz with ocean disposal at Santa Cruz	20,789	5,021	592	694	36,127
IB	Consolidation of all flows at Santa Cruz with treatment Level 4 with stream flow augmentation or recreation reservoir reuse	47,014	11,014	2,625	3,069	100,196

Table 16-8. Cost of Interregional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
IA	Combine San Lorenzo Valley and Santa Cruz flows at Santa Cruz with discharge to ocean at treatment Level 2	26,048	5,825	684	835	44,442
IB	Combine San Lorenzo Valley and Santa Cruz flows at Santa Curz with recreation reuse at treatment Level 8	57,251	12,656	2,896	3,560	118,975
IIA	Combine San Lorenzo Valley, Santa Cruz, and Watsonville flows at Santa Cruz with discharge to ocean at treatment Level 2	40,533	7,542	1,160	1,327	68,461
IIB	Combine Santa Cruz Valley, Santa Cruz, and Watsonville flows at Santa Cruz with recreation reuse at treatment Level 8	78,067	16,129	4,496	5,266	166,667
IIIA	Combine Santa Cruz, Watsonville, and San Lorenzo Valley flows at Watsonville with discharge to Bay at treatment Level 2	39,602	7,542	1,277	1,444	68,847
IIIB	Combine Santa Cruz, Watsonville, and San Lorenzo Valley flows at Watsonville with agriculture reuse at treatment Level 8	56,137	16,129	3,678	4,448	131,220

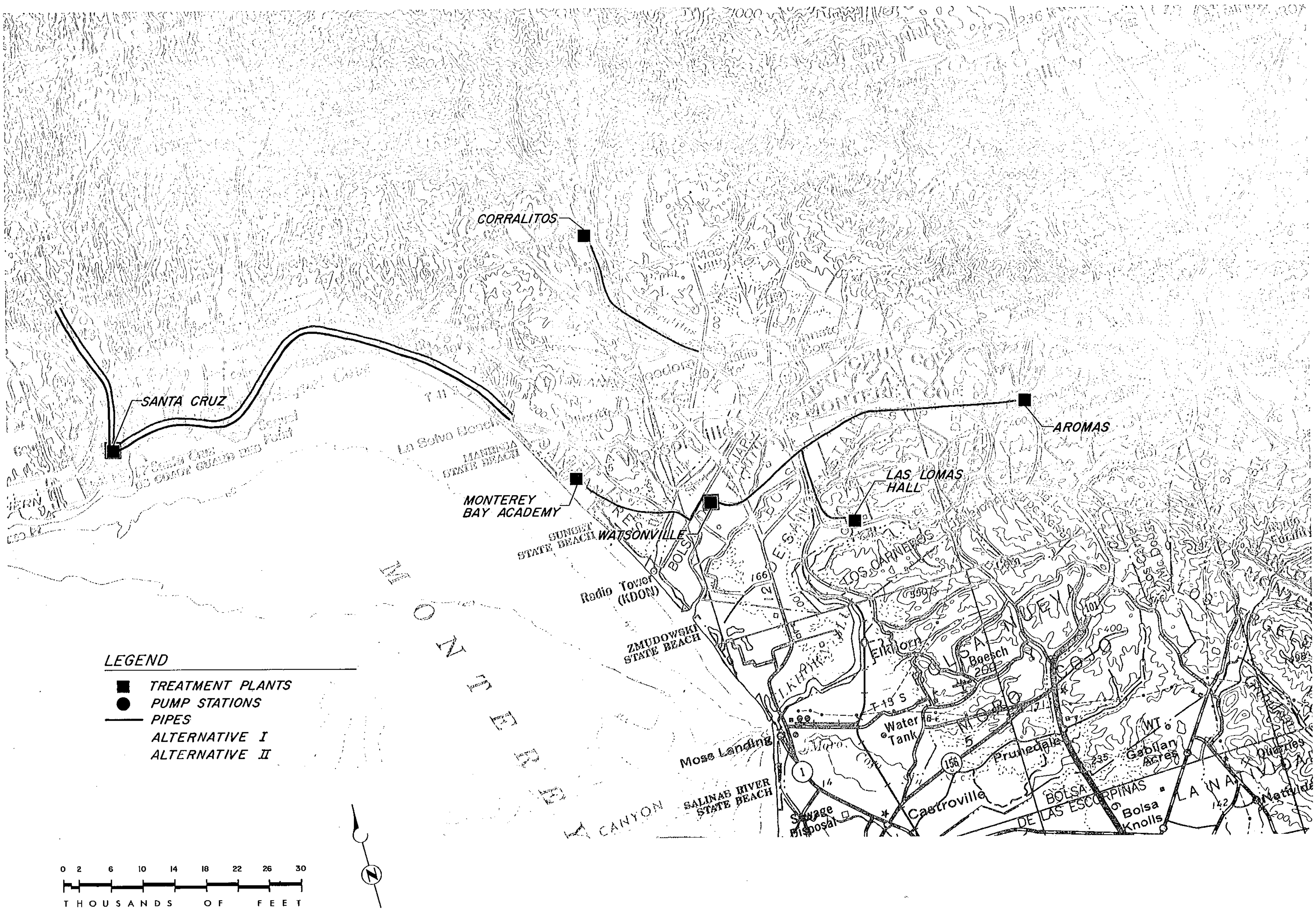


Fig. 16-5 Santa Cruz-Watsonville Alternatives

Creeks Sub-basins and the Watsonville Regions of the Pajaro River Sub-basin, various interregional consolidations were examined. Existing facilities in the Watsonville Region are described in the next section. The various interregional alternatives are discussed in subsequent paragraphs.

Alternative I consolidates flows from the Santa Cruz Region and the San Lorenzo Valley Region. It provides for a common treatment and disposal or wastewater reclamation facility at Santa Cruz. Treatment level II effluent would be discharged through an ocean outfall. Treatment level VIII effluent would be reused for stream flow augmentation or a recreation reservoir.

Alternative II combines the waste loads generated in the Santa Cruz, San Lorenzo and Watsonville Regions with common treatment and disposal or reclamation facilities at Santa Cruz. Treatment level II effluent would be discharged to the ocean through an outfall off Pt. Santa Cruz. At treatment level VIII, the effluent would be reused for stream flow augmentation or for a newly developed recreation reservoir.

Alternative III combines the waste flows generated in the three regions at Watsonville. At treatment level II, treated wastewater would be discharged to Central Monterey Bay through an outfall. At treatment level VIII, the treated wastewater would be reused in the Watsonville area for irrigation.

Costs of the interregional plans are shown in Table 16-8. Table 16-9 gives incremental costs for individual regions. Incremental costs are determined for each region by subtracting the costs for the other regions participating in the alternative from the total present worth cost. These are costs of the least costly alternative for the other regions.

Based on the incremental present worth value in Table 16-9, an economic advantage to both San Lorenzo Valley and the Santa Cruz Region will result if the San Lorenzo Valley flows are combined with the Santa Cruz flows for treatment and disposal through the Santa Cruz outfall. At the higher level of treatment, the most economically attractive alternative is Alternative IIIB, which combines the San Lorenzo Valley, Santa Cruz and Watsonville flows at Watsonville. The best wastewater reclamation and reuse potential in Santa Cruz County is in the Watsonville area where overdrafting of the groundwater basin has caused sea water intrusion. However, the incremental cost of providing treatment level VIII water is about $100/AF compared to a price of $10/AF for agricultural water which has been quoted by the USBR for supplemental water that could be developed by the San Felipe Project. Wastewater reclamation with the Watsonville flow alone could supply the agricultural area with a supplemental supply adequate for the near future. Thus, from an economic standpoint, the best near term solution for the Santa Cruz Region and San Lorenzo Valley is consolidation and treatment at Santa Cruz with ocean disposal.

PAJARO RIVER SUB-BASIN

Intraregional and interregional alternatives for the Watsonville, Gilroy and Hollister Regions are discussed below.

Watsonville Region

Sixteen alternatives, ranging from treatment and disposal facilities at each source to a total consolidation of waste flows with a common treatment and disposal facility, were identified for the Watsonville Region. Each alternative makes provisions for treatment and disposal of waste loads generated in the Aromas, Los Lomas-Hall, Pajaro, Watsonville, Corralitos and Monterey Bay Academy areas.

The City of Watsonville operates a domestic wastewater collection and treatment system. The City of Watsonville municipal wastewater system receives industrial wastes from Green Giant Company, Watsonville Canning, United Foods, Pacific Extrusion-Amteck, Mt. Madonna, California Canning, Crosetti Company, Martinelli Company and Heinz.

The City of Watsonville provides a primary treatment plant with a design capacity of 13.4 million gallons per day. The Salsipuedes Sanitary District, the Freedom County Sanitation District, the Pajaro County Sanitation District, the Pajaro Dunes development, and the City of Watsonville all contribute to the average flow of 5.6 million gallons per day which is discharged into Monterey Bay through a 39 inch outfall at a point 3,500 feet offshore and at a 40 foot depth. Treatment facilities include bar screens, pre-aeration tanks, sedimentation tanks, chlorine contact chamber and separate sludge digester. Two chlorinators provide post-chlorination at a dosage rate of 18 ppm.

Although the receiving water meets Water Con-

Table 16-9. Cost Comparison of Interregional Alternatives, Thousands of Dollars

Alternatives	Total present worth costs	Incremental present worth costs		
		San Lorenzo Valley	Santa Cruz	Watsonville
Least costly or recommended alternatives for regions considered separately				
San Lorenzo Valley				
Secondary treatment with land disposal at each waste source	9,459	9,459		
Level 4 treatment and stream discharge	23,765	23,765		
Santa Cruz				
Consolidate all flows at Santa Cruz with ocean disposal	36,127		36,127	
Consolidate with recreation use	100,196		100,196	
Watsonville				
Consolidated treatment at Watsonville and bay disposal	18,812			18,812
Consolidated Level 4 treatment	51,261			51,261
Least costly or recommended alternatives for regions considered collectively				
San Lorenzo Valley and Santa Cruz				
(IA) Level 2 treatment and ocean discharge	44,442	8,315[a]	34,983[b]	
(IB) Level 8 treatment and recreation use	118,975	18,779[c]	95,210[d]	
San Lorenzo Valley, Santa Cruz, and Watsonville				
(IIA) Level 2 treatment and ocean discharge at Santa Cruz	68,461	13,522[e]	40,190[f]	24,019[g]
(IIB) Level 4 treatment at Santa Cruz	166,667	15,210[h]	91,641[j]	47,692[k]
(IIIA) Level 2 treatment at Watsonville and bay discharge	68,847	13,908[m]	40,576[n]	24,405[p]
(IIIB) Level 8 treatment at Watsonville and agricultural reuse	131,220	- [q]	56,194[r]	12,245[s]

a 44,442 - 36,217
b 44,442 - 9,459
c 118,975 - 100,196
d 118,975 - 23,765
e 68,461 - (36,127 + 18,812)
f 68,461 - (18,812 + 9,459)
g 68,461 - 44,442
h 116,667 - (100,196 + 51,261)
j 166,667 - (51,261 + 23,765)
k 166,667 - 118,975
m 68,948 - (36,127 + 18,812)
n 68,847 - (9,459 + 18,812)
p 68,847 - 44,442
q 131,220 - (100,196 + 51,261)
r 131,220 - (23,765 + 51,261)
s 131,220 - 118,975

tact Sports Standards, it does not meet the Water Quality Standards for Shellfish Harvesting during that portion of the year that shellfish coliform standards apply. Tentative plans have been made to add secondary treatment facilities which should yield more reliable coliform control. The coliform problem is not entirely attributable to the Watsonville discharge and consequently, these facilities may or may not result in a receiving water quality that meets shellfish standards.

The Pajaro Sanitation District provides collection and screening for all wastes. A 2.25 million gallon per day (mgd) pump station and interceptor line carries the wastes to the Watsonville Plant for treatment and disposal. The district collects wastes from Southern Pacific Company, California Farm Products, Marinovich Cold Storage Company, J.J. Corsetti Company and Kritscht Pipe Company.

The Monterey Bay Academy uses lagoons to dispose of its raw wastewater. This facility is currently meeting discharge requirements.

Two regional alternatives are presented in Table 16-9 for the Watsonville Region. These alternatives, remaining after initial screening based on costs, would retain flows generated in the Watsonville Region for treatment and disposal or reuse. The alternatives are shown in Figure 16-5.

Alternative I would provide treatment and land disposal facilities at Aromas, Corralitos and Los Lomas-Hall, and upgrade and expand the treatment facilities at Watsonville and Monterey Bay Academy with disposal to Monterey Bay. Alternative IIA would consolidate all flows at Watsonville with disposal to Monterey Bay after secondary treatment. Alternative IIB would have the same physical configuration, but a higher level of treatment. Treatment level VIII water could be reused in the lower Pajaro Valley for irrigated agriculture.

The costs of the alternatives are shown in Table 16-10. The costs of these alternatives, as will be discussed in more detail in the section on interregional consolidation, are significantly less than costs to Watsonville for consolidation with flows from Santa Cruz. On the basis of cost, there is very little difference between the two alternatives which would provide for treatment and disposal of flows within the region. Alternative IIA, providing for consolidation at Watsonville, has a slightly greater present worth value than Alternative I but IIA would result in a slightly lower local cost. From both a disposal and reclamation point of view, costs indicate quite conclusively that wastewaters generated in the Watsonville Region should be treated and disposed of or reused within the region. Consideration of reclamation and reuse around Watsonville indicates a possible need for supplemental water may exist in connection with evidence of sea water intrusion into the Pajaro Valley groundwater basin.

On a functional basis, consolidation of flows at Watsonville for treatment and disposal would have a slight advantage over maintaining separate facilities at several small communities. Better assurance of protecting beneficial uses would provide the main advantage.

Gilroy Region

Three wastewater sources, Gilroy-Morgan Hill, San Martin and Gilroy Industrial, are included in the Gilroy Region. Gilroy and Morgan Hill are included as one source since the waste flows from both cities are currently treated at Gilroy. Seven alternatives were identified for the Gilroy Region. The alternatives range from providing treatment and disposal facilities at each area to total consolidation of the areas with a common treatment and disposal facility.

The City of Gilroy provides a primary treatment plant with a design capacity of 3.0 million gallons per day. The average flow of 1.9 million gallons per day represents a combined flow from both Gilroy and Morgan Hill. The effluent is discharged to percolation and evaporation ponds. Treatment facilities consist of two separate plants. Approximately one-third of the flow is treated by a plant using an aerator and a square primary clarifier. The remaining two-thirds is treated in the new facility which consists of a circular clarifier with provision for aeration in the influent compartment (Walker Process). The influent structure includes a bar rack, a Parshall flume and a flow-spitter.

Although the discharge is presently in compliance with waste discharge requirements, plans have been made to convert the plant, which was originally constructed in 1929, to secondary treatment and to increase the design capacity to 8.0 million gallons per day. A new method of disposal, consisting of either additional percolation ponds or river discharge, will also become necessary during the next five years.

Table 16-10. Cost of Watsonville Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Maintain treatment and disposal facilities at Aromas, Corralitos, Los Lomas-Hall, Pajaro, Watsonville, and Monterey Bay Academy	7,269	2,874	541	686	18,812
IIA	Consolidate all flows at Watsonville with secondary treatment and bay disposal	9,168	2,915	492	556	19,523
IIB	Consolidate all flows at Watsonville and provide treatment Level 8	17,582	6,634	1,846	2,117	51,261

Table 16-11. Cost of Gilroy Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Maintain separate facilities at Gilroy, Gilroy Industrial, and San Martin with land disposal	14,443	5,157	592	868	30,761
IIA	Consolidate flows and treat at Gilroy with land disposal	12,690	5,222	437	627	25,967
IIB	Consolidate flows and provide treatment Level 8	23,122	11,422	1,558	2,367	63,666
IIIA[a]	Combine Hollister Region flows and treat at Gilroy with disposal to land	15,547	5,222	195	306	25,395
IIIB[a]	Combine Hollister flow and treat at Gilroy at Level 8	20,106	10,527	1,045	1,725	51,672

[a] Incremental cost

Gilroy's industrial collection system receives wastewater from the Cal-Can Cannery, the Gilroy Foods dehydrator and the Gentry, Inc. dehydrator. The Gilroy industrial treatment facility consists of stabilization ponds with the effluent disposed of by percolation ponds. Odor control is a problem during the peak canning season.

The unincorporated area of San Martin is the only developed, unsewered area which may require sewering in the near future.

Two alternatives out of the seven are presented in Table 16-11 along with an alternative which combines all flows in the Gilroy Region with flows from the Hollister Region. The two alternatives for the Gilroy Region represent first, the maintenance of separate facilities at each waste load source and secondly, the most economically attractive plan that consolidates these waste loads.

Alternative I involves the upgrading and expansion of facilities at Gilroy, Gilroy Industrial and San Martin with disposal to land. Alternative II, at treatment level II, would have the flows of Gilroy, Gilroy Industrial and San Martin treated at Gilroy with disposal to land. Alternative II was also listed at treatment level VIII in order to obtain an incremental cost for reclaiming water at Gilroy. Alternative III calls for treating the wastewaters from the Holister Region, including San Juan Bautista, Hollister, Hollister Industrial and Hazel Hawkins Hospital, at Gilroy in addition to all flows generated in the Gilroy Region, Costs are presented for both treatment levels II and VIII.

The costs for the alternatives are given in Table 16-11. Table 16-11 shows that consolidation at Gilroy is best. Alternative IIIA which combines Hollister with Gilroy appears to be particularly good when viewed from the standpoint of local equivalent annual costs. The local cost for IIIA and IIA would be $820,000/yr and $1,040,000/yr, respectively.

Alternative IIIB which combines the flows from the Gilroy and Hollister Regions with a common treatment and wastewater reclamation facility near Gilroy would result in an incremental cost of about $80/AF to produce reclaimed water. This is considerably more expensive than alternative supplies. Suggested prices for San Felipe Project water are $30/AF for municipal and industrial uses and $10/AF for agricultural use. It is estimated that supplemental groundwater supplies could be developed for under $30/AF in the Gilroy area.

There is no clear choice among the alternatives with respect to their functional capabilities. There may be a slight advantage for a consolidated system near Gilroy. With a consolidated system, one land disposal system would be eliminated in the Gilroy area, however site location may be more important particularly as related to effects on local groundwaters. Maintenance of separate facilities may be desirable where land disposal following secondary treatment is emphasized; where treatment levels are higher, consolidation may be more desirable from an operational standpoint.

Hollister Region

Twenty-four alternatives, each of which provides for the treatment and disposal of waste loads generated in the San Juan Bautista, Hollister, Hollister Airport, Hollister Industrial, San Benito County Hospital and Tres Pinos areas, were identified for the Hollister Region. The alternatives range from providing individual treatment and disposal facilities for each area to total consolidation of the flows of the areas and the provision of a common treatment and disposal facility.

The City of San Juan Bautista now operates a secondary treatment facility which was recently expanded to an estimated capacity of 240,000 gallons per day. The average flow of 113,000 gallons per day is discharged to a drainage ditch which is tributary to the San Benito River. San Juan Bautista collects wastewater from Vessey Garlic Packing, Inc. and Botelho Brothers Potato Shed in its municipal collection system. The San Juan Bautista treatment plant is meeting existing requirements established by the Regional Board.

The City of Hollister plant provides a primary treatment plant with a design capacity of 1.0 million gallons per day. The average flow of 0.67 million gallons per day is discharged into infiltration beds. Treatment facilities include comminutor, steel circular clarifier, digester, gas burner, sludge drying beds and 11 acres of effluent infiltration beds. An additional clarifier and an interceptor to the infiltration beds have been scheduled for construction to meet the future waste flow projections.

Hollister Municipal Airport operates raw sewage lagoons capable of providing primary treatment for 250,000 gallons per day although the average flow is only 8,000 gallons per day. This system would be enlarged and renovated within the near future.

The City of Hollister provides collection, treatment and disposal facilities which are separate from their domestic sewage systems for industries located within the city boundaries.

The Hollister industrial wastewater disposal facilities are located adjacent to the San Benito River. These consist of aeration and percolation ponds which allow the treated wastewater to percolate to the underlying groundwater. This discharge is in compliance with the waste discharge requirements as set by the Regional Board. Although the new plant was completed in 1972, odor control continues to be a chronic problem. The location of the industrial plant, between the San Benito River and residential areas of the city, has been questioned because of the odor problems and the potential for degradation of the river by subsurface flow from the percolation ponds.

The former San Benito County Hospital facility receives waste from the County Roads Department, San Benito County School for Boys, two farm labor camps and Hazel Hawkin's Southside Hospital. The treatment facility consists of raw sewage lagoons with a design capacity of 80,000 gallons per day. The average flow to these lagoons is 50,000 gallons per day. This discharge currently meets the requirements established by the Regional Board.

Tres Pinos County Water District operates raw sewage lagoons which have a design capacity of 60,000 gallons per day. The current average flow of 4,000 gallons per day percolates into the San Benito Groundwater Basin. No problems relative to water quality control have been identified with this facility.

Two regional alternatives are presented in Table 16-12. An interregional alternative which combines the flows in the Hollister Region with Gilroy at Gilroy is also shown. This is the same interregional alternative which was discussed in the section on Gilroy. Many of the alternatives combining Tres Pinos, San Juan Bautista and the Hollister Airport can be eliminated on the basis of excessive cost. The projected flows are small and these waste load sources are far apart.

Alternative I would provide for upgrading and expansion of separate facilities at Hollister, Hollister Industrial, Hollister Airport, San Juan Bautista, Tres Pinos and the San Benito County Hospital with disposal to land after secondary treatment. Alternative II calls for combining all flows except Hollister Airport and Tres Pinos at Hollister where treatment level II (secondary) could be provided with land disposal facilities or treatment level VIII (tertiary) could be provided to produce reclaimed water. Alternative III would transport raw wastewater from the waste sources in the Hollister Region to Gilroy for treatment and disposal or reuse. Only Tres Pinos would not be included in this interregional alternative. The Hollister Airport is included because of its proximity to the interceptor route.

The costs of the alternatives are shown in Table 16-12. Consolidation of Hollister Regional Flows with Gilroy at Gilroy appears to be slightly better than treating waste flows within the Hollister Region, on the basis of costs. The local equivalent annual cost for Alternatives IIIA and IA are $440,000/yr and $650,000/yr, respectively.

The incremental cost of providing reclaimed wastewater as in Alternative IIB is close to $95/AF. As has been pointed out previously, water from the USBR's San Felipe project is expected to be priced at a lower cost.

In order to provide maximum protection to existing and anticipated beneficial uses, alternatives which would retain waste flows in the Hollister Region for treatment and disposal are favored. Consolidation of waste loads at Hollister would provide a more reliable system than if wastewater continues to be treated on an individual basis. Alternative IIA would best accomplish these two functional considerations. The San Juan Bautista area may be adequately served by separate facilities if equivalent reliability of land disposal operations for groundwater protection can be demonstrated.

The Aromas Water District serves an area of 1,200 acres and approximately 500 people. Plans for the district include construction of a collection system, lift stations and a 225,000 gallon per day treatment facility with a land disposal system.

SALINAS RIVER SUB-BASIN

The Salinas River Sub-basin has been divided into seven regions for alternative plan development purposes. The last three discussed are the Castroville, Salinas and Monterey regions; these are considered separately and in combinations

Table 16-12. Cost of Hollister Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Maintain separate facilities at Hollister, Hollister Industrial, Hollister Airport, San Juan Bautista, Tres Pinos, and San Benito County Hospital with land disposal	4,606	605	479	542	12,394
IIA	Consolidate flows at Hollister, except Hollister Airport and Tres Pinos, with land disposal	6,646	502	378	395	13,012
IIB	Same as IIA, except treatment Level 8 would be provided for consolidated flows	13,042	2,292	1,357	1,451	34,758
IIIA[a]	Combine Hollister Region, except Tres Pinos at Gilroy, with land disposal	7,463	605	237	171	11,822
IIIB[a]	Same as IIIA, except treatment Level 8 would be provided at Gilroy	10,450	1,302	823	784	22,874

[a] Incremental costs

Table 16-13. Cost of Castroville Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Maintain separate treatment and disposal facilities at a secondary level of treatment	2,322	387	101	220	5,497
IIA	Consolidate all flows at Castroville and provide secondary treatment and outfall	3,928	306	94	171	6,468
IIB	Consolidate all flows at Castroville and provide treatment Level 6	3,931	1,245	133	283	7,711

involving differing degrees of consolidation of municipal wastewater facilities. The remaining four regions are Toro, Salinas Valley, Nacimiento and San Luis Obispo; each of these regions is considered in a separate discussion.

Castroville Region

The Castroville Region includes the four wastewater sources of Moss Landing, Castroville County Sanitation District, Oak Hills and Prunedale. The unincorporated developed, unsewered areas of Moss Landing, Prunedale and rural Castroville will require wastewater facilities in the near future, unless Sewerage Feasibility Studies indicate sewers will not be necessary to protect water quality. For example, the Prunedale area has not experienced significant problems with septic tank systems.

Castroville County Sanitation District provides a secondary treatment plant with a design capacity of 0.8 million gallons per day. The plant discharges an average of 0.4 million gallons per day into Tembladero Slough which in turn empties into Moss Landing Harbor. Treatment facilities include an activated sludge tank, two spiral vortex units, separate sludge digesters and a chlorine contact chamber.

Although the plant is well operated and maintained it is periodically subjected to dramatic increases in the strength of influent sewage as a result of variable operation of artichoke processing plants. During these periods the effluent suspended solids exceeds the discharge requirements set by the Regional Board. Recent changes at the artichoke packing sheds may reduce or eliminate this problem in the future.

The Castroville County Sanitation District plant receives wastes from six industries: Artichoke Industries, Inc., Castroville Marketing Association, Boggiatto Packing Company, Associated Produce Distributors, Monterey Bay Packing Company and California Artichoke & Vegetable Growers, Inc.

Because of the age and physical layout of the treatment facilities, expansion of this plant may not be feasible. A separate new facility may be more desirable.

The Oak Hills subdivision is served by a privately-owned treatment facility. Wastewater is treated in raw sewage lagoons with a total capacity of 150,000 gallons per day. Treated wastes are disposed of in percolation-evaporation ponds. This facility was constructed in 1968 and currently meets discharge requirements.

Several regional alternatives were identified for the Castroville Region. Interregional consolidation with the Salinas area has also been considered and these alternatives are discussed below. From a cost standpoint, interregional alternatives are inferior to the Castroville region considered separately.

The intraregional alternatives shown in Figure 16-6 involve the consolidation of flows at various locations within the region, as well as considering separate treatment facilities at each location. The analysis showed that if the Castroville region is considered by itself, and only secondary treatment is provided, the least costly alternative is separate facilities at each of the four waste sources. The least costly alternative providing regional consolidation and secondary treatment, is to provide treatment in an expanded plant for all flows from the four sources, Moss Landing, Castroville County Sanitation District, Oak Hills and Prunedale, at the present location of the Castroville County Sanitation District plant. If a level of treatment greater than secondary is provided, then the least costly alternative for the region considered alone is to consolidate flows at the Castroville plant rather than to provide separate treatment at each source. Costs when the Castroville region is considered by itself are shown in Table 16-13.

Salinas Region

The Salinas region includes two domestic sewage collection and treatment systems and one industrial collection and treatment system operated by the City of Salinas which serves 22 industries. In addition, 13 privately-owned systems treat industrial waste. There are two developed, but unsewered, areas within the Salinas planning area which plan to construct wastewater collection systems in the near future.

The Salinas Industrial waste treatment facility which is located in the South Salinas planning area is included in the Salinas planning area for purposes of this report.

The City of Salinas Main Plant provides secondary treatment with a design capacity of 7.0 million gallons per day. An average flow of 5.2 million gallons per day is discharged into the Salinas River. However, a portion of the peak flow

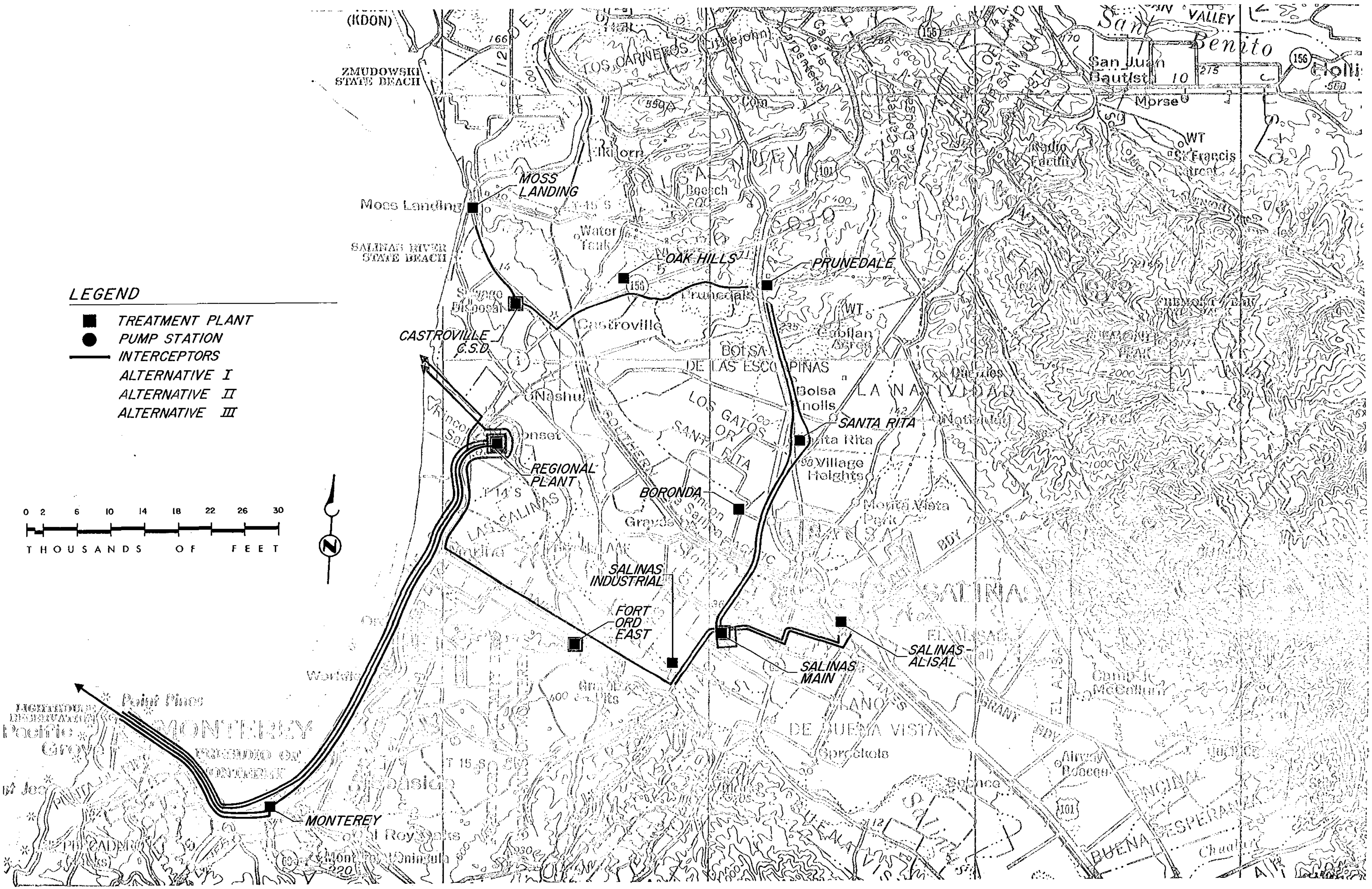


Fig. 16-6 Monterey-Salinas-Castroville Alternatives

occasionally must bypass the plant and be diverted to the holding ponds. Present treatment facilities include comminutor, primary and secondary clarifiers, trickling filters, settling tanks, separate sludge digesters, and pre- and post-chlorination facilities. Nutrient removal facilities will be needed in 1975 in order to meet proposed discharge requirements. Future residential development in the Salinas area may eventually surround the present plant site. It may be desirable to relocate the plant prior to any major expansion.

The City of Salinas' Alisal plant provides secondary treatment with a design capacity of 2.0 million gallons per day. The average flow of 1.1 million gallons per day is discharged into the Salinas River. Treatment facilities include comminutor, grit removal and pre-aeration chamber, sedimentation basins, two trickling filters, final clarifier, separate sludge digesters and chlorination. This facility is old, and the city plans to abandon it and consolidate flows at the main plant in the near future.

The City of Salinas has industries discharging into the municipal wastewater system, the separate industrial system, and the Salinas Reclamation Canal. Those industries using the municipal treatment and disposal facilities are given in Table 16-14. The Salinas Industrial facility and those industries operating separate treatment and disposal operations are identified in the section on industrial facilities.

It is probable that nearly all of the discharges in this planning area affect the natural water quality conditions. The entire dry weather flow in the Salinas River below Spreckels is the result of discharges from the City of Salinas and agricultural return water.

The Boronda Water District serves approximately 1,255 people. The district has plans to construct a collection system, lift stations, and a trunk line to the City of Salinas for treatment of the projected 125,500 gallons per day of wastewater.

The Santa Rita Water District and Gabilan Acres area covers approximately 5,880 acres and contains about 3,500 people. An interceptor from Santa Rita to the City of Salinas was recently constructed and all new developments within the district will be sewered. Santa Rita and Gabilan Acres have scheduled the construction of collection systems, with an interceptor from Gabilan Acres to Santa Rita. The projected flow of 350,000 gallons per day from this area would be treated at the City of Salinas.

Nine alternative configurations of intraregional consolidation were analyzed when the Salinas Region was considered by itself. These alternatives ranged from providing treatment and disposal facilities at each waste source to total consolidation of all municipal waste flows generated in the region at a common treatment plant located near the present location of the Salinas main plant. Each of the alternatives considered provided for treatment of waste loads generated at Prunedale, Santa Rita, Boronda, Salinas, Alisal and the Salinas Industrial Center. It should be noted that when regional configurations were considered, Prunedale was considered in both the Salinas and Castroville Regions in order to assure the most efficient choice. However, since interregional consolidation including Salinas and Castroville is recommended, this became academic.

Costs of three least costly regional alternatives are presented in Table 16-15. Alternative II calls for the consolidation of flows and treatment near the present location of the Salinas main plant. Treatment would be provided to a level VI that would allow disposal of water to the Salinas River when it was not being used for irrigation. During the nonirrigation season, effluent disposal to the Salinas River would require nutrient removal.

Alternative I involves a separate level VI treatment at each waste source location. However, this is more costly than consolidated regional treatment.

Alternative III, the least costly alternative, for the Salinas Region would involve level II treatment with disposal by outfall to central Monterey Bay until 1985. At that time, treatment would be upgraded to level VI and effluent would be provided for irrigation or disposed of to the Salinas River during the nonirrigation season.

Initially an analysis was made for the Salinas Region, assuming that secondary treatment with land disposal would be satisfactory. The cost, either for separate or consolidated treatment, was determined to be on the order of $19,500,000.

Monterey Region

Over 100 alternative configurations, each of which makes provisions for treatment and disposal of waste loads generated in the Marina, Fort Ord-Main, Fort Ord-East, Seaside, Monterey, Pacific Grove, Laguna Seca and Hidden Hills areas were identified and analyzed for the Monterey Region. The alternatives range from providing

Table 16-14. Industries Discharging to the City of Salinas Municipal Sewage System

Blue Ribbon Dairies	Foremost Dairies, Inc.
Hoerner Waldorff Corp.	Smucker's
Triangle Company	Shell Ammonia Service Co.
Mission Linen Supply	Alisal Laundry
American Laundry	Great Western Laundry
Spin Wash Laundry	Sherwood Laundry
Mission Industrial Supply	Valley Center Laundromat
Sparkle Laundry	Pepsi-Cola Bottling Co.
Coca-Cola Bottling Co.	Sofspra Car Wash (2)
Sherwood Garden Car Wash	Acme Car Wash
Auto-Villa Car Care	Econo-Shine
Deep Steam Carpet Clean	Lee's Laundry
New Method Rug Cleaners	U Wash N Dry N Save
Royal Crown Bottling Co.	7-Up Bottling Co.
Granny's Wash & Dry	Laundry Basket
Osita Inc.	Loy Wong

Table 16-15. Cost of Salinas Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1974	1985	
I	Maintain separate facilities with Level 6 treatment	20,590	7,615	1,669	2,041	54,214
II	Consolidate flows at Salinas with Level 6 treatment	25,212	6,195	1,291	1,514	52,118
III	Consolidate flows at Salinas with Level 2 treatment and Mid Bay outfall until 1985	22,912	15,333	535	1,614	51,879

treatment and disposal facilities at the location of each waste load to total consolidation of the waste loads of all areas, with a common treatment and disposal facility.

The Marina County Water District operates a 1.0 million gallon per day secondary treatment plant. The average flow of 160,000 gallons per day is discharged to Monterey Bay through a 14 inch diameter outfall at a point 2,400 feet offshore and at a 40 foot depth. An additional 1.0 million gallons per day activated sludge package treatment plant is scheduled for completion to provide for projected flows.

The U.S. Army, Ft. Ord Main Garrison plant, provides secondary treatment and has a design capacity of 4.2 million gallons per day. The plant discharges an overage of 2.9 million gallons per day into Indian Head Beach through a storm drain. Treatment facilities include comminutors, grit chamber, primary and secondary clarifiers, trickling filters, separate sludge digesters and a chlorine contact chamber.

Although the effluent quality is excellent, odor problems have occurred in the past. The discharge is not in compliance with waste discharge requirements because it flows directly onto the beach rather than through an outfall. Alternatives are being examined which would include Ft. Ord in the proposed Tri-Cities plan. These alternatives are discussed later in the section covering Carmel River Sub-basin.

The U.S. Army, Ft. Ord East Garrison plant, consists of a Doten tank which discharges to percolation-evaporation ponds. This facility, originally built to serve the East Garrison, serves a daytime population of 100. There is no available information on the capacity or the quality of treatment of this plant. The East Garrison plant is presently meeting existing discharge requirements established by the Regional Board. The U.S. Army also maintains an Imhoff tank to serve their aviation facilities at Fritzche Field. Treated effluent is disposed of by percolation.

The Seaside County Sanitation District operates a primary treatment plant with a design capacity of 2.0 million gallons per day. The average discharge of 1.6 million gallons per day flows into Monterey Bay through a 750 foot outfall at a depth of 30 feet. Treatment facilities include comminutor, sedimentation tanks, sludge thickening tank and separate sludge digesters. Two flow proportional V-notch chlorinators provide pre- and post-chlorination at dosage rates of 6 and 30 ppm, respectively.

The discharge is currently in compliance with waste discharge requirements, however, studies are being made in conjunction with the Cities of Monterey and Pacific Grove in an attempt to eliminate the discharge from Monterey Bay. The district plans to add chemical flocculation equipment to increase the removal of suspended solids. Because of land restrictions, expansion of this facility is not considered feasible.

The City of Monterey operates an activated sludge plant with a design capacity of 4.6 million gallons per day. The average flow of 2.6 million gallons per day is discharged into Monterey Bay through an 800 foot outfall at a depth of 30 feet. Treatment facilities include a comminutor, activated sludge tank, sedimentation basins, separate sludge digester and sludge incineration. A flow proportional V-notch chlorinator provides pre- and post-chlorination.

The discharge is currently not in compliance with waste discharge requirements relative to suspended solids. Studies are being made in conjunction with the Cities of Pacific Grove and Seaside in an attempt to eliminate the discharge from Monterey Bay. Because of land restriction, expansion of this plant into a regional facility is not considered feasible.

The City of Pacific Grove currently operates a primary treatment plant with a design capacity of 2.0 million gallons per day. The effluent, averaging 1.3 million gallons per day, is discharged into Monterey Bay through an outfall which terminates in the rocks at Pt. Pinos. Treatment facilities include comminutors, a clarifier, and separate sludge digester. A flow proportional V-notch chlorinator provides post-chlorination.

The collection system serving Pacific Grove currently has a problem with storm water infiltration which causes wet weather flows to exceed dry weather flows by about 300 percent. Pacific Grove expects to begin an infiltration correction program.

The discharge does not meet the requirements set by the Regional Board. The point of discharge is unsatisfactory due to its proximity to shore and public access. From the few ocean current studies conducted by the Hopkins Marine Station, it appears that the currents in the vicinity of the present outfall either push the effluent on-shore or move it back into Monterey Bay. For this reason, alternative methods of disposal are being examined in the South Monterey Bay Sewerage Study (commonly called the Tri-City Study) in which the City of Pacific Grove is participating in conjunction with the Cities of Monterey and Seaside. The South Monterey Bay Sewerage Study is discussed following the descriptions of the City of Monterey and Seaside County Sanitation District.

The Laguna Seca subdivision is sewered to a common septic tank. Effluent is disposed of in a subsurface leach field. No problems relative to water quality have been identified with this facility.

The Hidden Hills subdivision uses raw wastewater stabilization ponds and spray irrigation to treat and dispose of waste flows. This facility is currently in compliance with discharge requirements established by the Regional Board.

Opportunities for nearby land disposal of treated wastewaters generated in Pacific Grove, Monterey and Seaside are virtually nonexistent. These areas are either highly developed or the terrain is unsuitable for land disposal. There is one area north of Ft. Ord that may be suitable for land disposal. Since reclamation possibilities are very limited on the Monterey Peninsula, ocean disposal of wastewaters produced at Pacific Grove, Monterey and Seaside is the only practical solution when disposal of these waste loads is considered separately.

On the basis of findings of studies of Monterey Bay, discussed in Chapter 11, it was concluded that alternatives in the Monterey Region should be limited to those alternatives which consolidated the wastewaters of Pacific Grove, Monterey, Seaside and Ft. Ord. Treated effluent would be disposed of through an ocean outfall at Pt. Pinos or transported toward Central Monterey Bay for disposal through an outfall to the Bay or for reclamation and reuse by irrigation in the Castroville area. Once it was determined that transfer of waste flows generated on the Peninsula toward the Central Bay was feasible, it was logical to consider consolidating flows from the Monterey and Salinas Regions. Interregional consolidations are discussed in a subsequent section of this chapter. The following paragraphs of this section discuss the intraregional alternatives which remained after the preliminary screening based both on cost and environmental considerations.

Alternative I involves consolidation of the flows of Marina, Ft. Ord, Seaside, Monterey and Pacific Grove with common treatment and disposal and wastewater reclamation facilities near Monterey. The first phase of Alternative I would provide for secondary level of treatment and discharge to the ocean through an outfall off Pt. Pinos. The second phase would provide for reclamation and transport of treated wastewater to the lower Salinas Valley. The reuse potential on the peninsula is poor since there are no major groundwater aquifers that could be recharged or agricultural lands that could be irrigated. The costs of including waste loads generated at Laguna Seca, Hidden Hills and Ft. Ord-East in a consolidated plant are considerably greater than those of maintaining separate facilities for these sources. Consequently, separate facilities are indicated for those waste loads.

Alternative II would involve the consolidation of the same flows, but the total flow would be moved northerly to a point near Marina where common treatment and disposal or wastewater reclamation facilities would be provided. Alternative II holds a significant advantage over Alternative I in that the waste loads are initially transported toward the major potential reuse area. Alternative II involves a secondary level of treatment and disposal through an outfall to Central Bay until 1985 and then construction of level VI treatment facilities. Alternative III is a variation of Alternative II and would have level VI treatment facilities constructed immediately with disposal to the Salinas River during those periods when the reclaimed water was not being used for irrigation. The reclamation facilities would provide for nutrient removal but would not include demineralization processes. Total dissolved solids (TDS) concentrations exceed 1000 mg/l in most of the upper (180 foot) aquifer from Salinas to the Bay. It is estimated that the combined total dissolved solids content of domestic wastewater from the Monterey Peninsula would be 650 mg/l without demineralization. Consequently, the reuse of such water would not degrade the supplies in the upper aquifer. However, the quality of water in the underlying 400 foot aquifer is better, averaging about 400-500 mg/l TDS around Salinas. The groundwater system would have to be managed in conjunction with the reclamation project to assure that the waters in the 400 foot aquifer are not degraded.

The costs of the three alternatives discussed above are shown in Table 16-16.

Table 16-16. Cost of Monterey Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Discharge off Point Pinos - reclamation beginning in 1985	27,125	15,185	620	1,100	50,405
II	Discharge to Central Bay - reclamation beginning in 1985	24,335	9,570	605	1,005	42,815
III	Discharge to Salinas River - reclamation immediately	22,937	4,852	1,237	1,326	48,238

Table 16-17. Evaluation of Functional Factors of AMBAG Alternative Plans[a]

Factor	Alternative I	Alternative II	Alternative III	Recommended plan[b]
Effectiveness	Fair	Good	Excellent	Excellent
Reliability	Good	Good	Good	Good
Flexibility	Fair	Good	Excellent	Excellent
Implementation	Good	Good	Good	Good
Reclamation potential	Fair	Good	Excellent	Excellent
Compatibility	Fair	Good	Good	Good
Overall rating	Fair	Good	Good	Good

[a] Functional evaluation described as poor, fair, good, and excellent.

[b] Monterey, Salinas, and Castroville combined.

Table 16-17 compares the evaluation of the functional factors of alternative plans for the Monterey Peninsula with the recommended plan. Overall, the early reclamation options appear to be functionally superior. Further, consolidation and treatment as provided in the recommended plan are environmentally superior to any plan which disposes of effluent through a bay or ocean outfall.

In terms of protecting surface and groundwaters for beneficial uses, the recommended plan involving reclamation and reuse is superior to the outfall alternative. A higher quality of effluent would be discharged during those periods when the reclaimed water was not in demand and the reuse of reclaimed water would result in reducing the pumping in the lower pressure unit causing a stabilization of groundwater levels and quality.

All alternatives are considered to be equally reliable in terms of the ability of the systems to perform.

The Monterey Peninsula alternatives which move the waste loads of the Peninsula toward the Marina or Salinas area for treatment and disposal or reuse are clearly more adaptable to possible future changes than the alternatives calling for disposal off Pt. Pinos. The Major potential reuse area is in the Castroville area and the possibility of connecting Castroville and Moss Landing into an interregional system of consolidation is better than it is with the Pt. Pinos alternative.

The implementation of all alternatives considered could be accomplished without a great deal of difficulty. The recommended plan of combining Salinas with the Monterey Peninsula is a little more complicated institutionally, but it is not expected to present a major stumbling block to the ability to implement such a plan. Since all alternatives call for reclamation and reuse eventually, the only problem with public acceptance is the matter of timing and the risk of incurring costs for operating and maintaining high treatment level facilities for a time before a contract for repayment can be executed.

Analysis of the groundwater quality situation in the lower Salinas Valley suggests that there is a market for reclaimed water at the present time. The recommended plan best meets this need.

Alternatives calling for treatment and reclamation of Monterey Peninsula waste flows near Salinas are contrary to the Interim Plan and the existing Tri-Cities plan, but it is believed that the AMBAG regional planning approach can supersede those plans since it has been clearly demonstrated that the recommended plan provides a better wastewater management strategy.

Interregional Alternatives

For the Castroville, Salinas and Monterey Regions, the various configurations which involved interregional consolidation of waste flows with treatment at large interregional plants were examined. Alternative combinations of regions considered for consolidation are the following: Castroville and Salinas; Salinas and Monterey; and Castroville, Salinas and Monterey. Costs of interregional alternative plans are shown in Table 16-18. Table 16-19 gives incremental costs for individual regions. Incremental costs are determined for each region by subtracting from total present worth cost, the costs for the other regions participating in the alternative. These are costs of the least costly alternative for the other regions.

Castroville and Salinas.

The alternative of transporting Castroville flows to Salinas for treatment in an interregional plant requires a higher level of treatment (level VI) for Castroville flows than a separate plant or regional plants at each waste source. This is because the least costly environmentally acceptable means of disposal of flows treated at Salinas is to the Salinas River. Discharge to the Salinas River requires nutrient removal in order not to unacceptably degrade Salinas River and lagoon quality. As can be seen from Table 16-19 the higher level of treatment makes this a more costly alternative for Castroville than separate treatment. As Castroville flows increase, an interregional alternative involving consolidation with Salinas may be logical.

Salinas and Monterey.

The alternative of transporting waste flows from the Monterey Peninsula to the Salinas Region, with a single treatment plant for the consolidated flow, is the most attractive from the standpoint of cost. Total present worth of this plan is $85,900,000. As shown in Table 16-19, this alternative results in the least incremental cost to Salinas and to Monterey of any of the alternatives considered. As a point of interest, it is estimated that the present worth cost for a system serving only the Monterey Peninsula providing for secondary treatment and discharge to the area at Pt. Pinos to the year 2000 would be approximately

Table 16-18. Cost of Interregional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Castroville and Salinas consolidation Level 6 treatment, discharge to Salinas River during nonirrigation season	32,403	8,285	1,259	1,559	59,310
II	Salinas and Monterey consolidation Level 6 treatment, discharge to Salinas River during nonirrigation season	47,316	8,092	1,659	2,166	85,902
III	Castroville, Salinas, and Monterey consolidation (recommended plan)	50,653	10,485	1,965	2,441	95,326

Table 16-19. Cost Comparison of Interregional Alternatives, Thousands of Dollars

Alternatives	Total present worth costs	Incremental present worth costs		
		Castroville	Salinas	Monterey
Least costly alternatives for regions considered separately				
Castroville				
Separate Level 2 treatment, bay outfall	5,497	5,497		
Salinas				
Consolidated treatment with Level 6 treatment	51,879		51,879	
Monterey				
Mid Bay outfall, Level 6 treatment in 1985	42,815			42,815
Least costly alternatives for regions considered collectively				
Castroville and Salinas				
Level 6 treatment, discharge to Salinas River	59,310	7,431[a]	53,813[b]	
Salinas and Monterey				
Level 6 treatment, discharge to Salinas River	85,902		43,087[c]	34,023[d]
Castroville, Salinas, and Monterey				
Level 6 treatment, discharge to Salinas River	95,326	9,424[e]	47,014[f]	36,016[g]

[a] 59,310 - 51,879

[b] 59,310 - 5,497

[c] 85,902 - 42,815

[d] 85,902 - 51,879

[e] 95,326 - 85,902

[f] 95,326 - (5,497 + 42,815)

[g] 95,326 - 59,310

$40 million compared to the $34 million incremental cost for Monterey.

Castroville, Salinas and Monterey.

Table 16-19 shows the estimated cost for a plan involving consolidation of flows of the Salinas—Monterey—Castroville area in a large interregional treatment plant in the vicinity of Salinas.

This plan, with a present worth cost of $95,326,000, is more costly than a consolidated plan for Salinas and Monterey (present worth cost of $85,902,000) plus the cost of separate treatment for Castroville (present worth cost of $5,497,000), the sum of which is $91,399,000. Castroville waste flows, handled separately, would be given level II treatment (secondary) and discharged through an outfall to the Central Monterey Bay. When the Castroville flows are consolidated with Salinas and Monterey, level VI treatment (nutrient removal) is provided, and quality of effluent is then satisfactory for discharge to the Salinas River.

Benefits for this consolidation plan were calculated in the AMBAG study on the basis of irrigation use of effluent using the groundwater model to predict the agricultural water supply quality and the quality-use-benefit relationships to determine the gross sales of crops. It was estimated that an equivalent annual quantity of 15,000 acre-feet of effluent would be available for irrigation use during the study period. The net benefits of $217,000/year were taken as 50 percent of the increased gross sales of agricultural products irrigated with effluent rather than pumped water. Benefits result from the difference in quality of effluent water, which remained constant throughout the planning period, and the quality of groundwater which degraded over time. It was estimated that equivalent annual gross sales with effluent irrigation would be $4,577,000 and for the same area with pumped water, equivalent annual gross sales as a result of groundwater quality degradation would be $4,143,000. The difference is $434,000/year. Of this, it was assumed that 50 percent would be attributed to other factors of production and 50 percent could be attributed to the effluent as a benefit. Public health aspects of reuse on local crops were assumed to be adequately covered by treatment provided.

The equivalent annual cost of this plan, over and above secondary treatment, was calculated to be approximately $700,000 per year. The annual cost of pumping a quantity of groundwater equivalent to the effluent available for irrigation is approximately $560,000/year. The net cost attributable to reclaimed water use of the plan is therefore $140,000/year. The benefit-cost ratio of this plan is 217,000/140,000 or about 1.55 to 1. A program which considers staging alternatives is described in Chapter 5; the plan as discussed in Chapter 5 leaves some flexibility regarding timing for abandonment of the Castroville CSD treatment facility. Reclamation aspects of the plan are long-term goals; near-term facility improvements emphasize water quality control measures. Staging of Castroville may be delayed due to financing limitations.

Toro Region

The Toro area contains one privately-owned domestic sewage collection and treatment system. The Toro Canyon area is the only developed, unsewered area which will require sewering in the near future.

The Salinas Utilities Company (formerly Western Pacific) uses aerated lagoons to treat wastewater from the Toro Park system. Treated effluent is disposed of by land spraying. This facility is currently meeting discharge requirements. However, lack of available adjacent land may restrict future expansion.

The Toro Canyon area covers approximately 2,350 acres, and contains about 3,500 people. Plans are to provide this area with a collection system, pump station, and force main to either Western Pacific Services or the City of Salinas where the wastewater would be treated and discharged to either the land or the Salinas River.

Eight alternatives, each of which makes provisions for treatment and disposal of waste loads generated in the Toro Park, Toro Canyon and Pine Canyon areas, were identified for the Toro Region. The alternatives range from providing treatment and disposal facilities at each area to total consolidation of the areas with a common treatment and disposal facility. The flows are small and scattered, consequently, the best solution for the region is the maintenance of individual treatment facilities and either ponds or spray disposal facilities.

When interregional consolidation possibilities are examined, the most attractive solution for the Toro Region is to combine with Salinas. The best strategy for this region would be to enter the Monterey-Salinas Reclamation System.

Salinas Valley Region

Eighty-eight alternatives, each of which makes provisions for treatment and disposal of waste loads generated in the Chualar County Sanitation District, Gonzales, Soledad Correctional Training Facility, Soledad, Greenfield, King City, San Ardo and Slack Canyon Conservation Camp areas, were identified for the Salinas Valley Region. The alternatives range from providing treatment and disposal facilities at each area to total consolidation of the flows from these areas (except San Ardo and Slack Canyon CC). The waste loads are relatively small and scattered and consolidation of flows was determined to be economically infeasible. Separate treatment and disposal facilities are recommended for the Salinas Valley Region.

The estimated local connection charge for the Chualar County Sanitation District project of $824/connection gives rise to serious doubt that such a project is financially feasible. A possible solution is offered in Chapter 5. San Ardo also presents a problem with a local connection charge of $474/connection. Continued use of oxidation ponds in lieu of conventional secondary treatment facilities may be acceptable in some of these communities; this option may reduce local financial burden.

Chualar County Sanitation District operates a raw wastewater lagoon system of five ponds with no pretreatment other than a bar screen and comminutor. The design capacity of the ponds is 60,000 gallons per day; average flow is 17,000 gallons per day. The Chualar facility currently meets discharge requirements established by the Regional Board.

The City of Gonzales operates a system of six percolation ponds having the capacity of 250,000 gallons per day. The City of Gonzales has three industries; the Garin Company, Mission Foods and Gonzales Packing Company, that discharge to its municipal sewer system. The present average flow of 100,000 gallons per day is pumped to one of three ponds after passing through the headworks which include a barminuter, a wet well and wastewater pumps. While three of the ponds are operating in parallel, the other three are rested and reconditioned by means of disk harrowing. Additional oxidation and percolation ponds will be constructed to handle future flows. In the past, the Gonzales treatment facilities have been damaged by floods. Flood protection levees are planned for construction in the near future.

The Soledad Correctional Facility operates a secondary treatment plant with a design capacity of 750,000 gallons per day. The average flow of 520,000 gallons per day is generally discharged to percolation ponds near the Salinas River except during the summer months when much of the effluent is used for irrigation of feed crops. Treatment facilities include bar screen, comminutor, primary and secondary clarifiers, trickling filter, chlorine contact chamber, digesters, sludge drying beds, chlorination equipment, irrigation ponds and percolation area in the Salinas River flood plain.

The City of Soledad operates a primary treatment plant with a design capacity of 390,000 gallons per day. The average flow of 280,000 gallons per day discharges to percolation beds after passing through the oxidator and a series of 11 small ponds. Treatment facilities include comminutor, oxidator, uncovered digester, sludge drying beds, 11 ponds and 13 percolation beds. Percolation ponds and disposal ponds are scheduled for construction.

The City of Greenfield provides a primary treatment plant which has a design capacity of 200,000 gallons per day. The average flow of 160,000 gallons per day is discharged to percolation ponds. Treatment facilities include comminutor, pre-aeration unit, sedimentation basin, uncovered digester, sludge drying beds and percolation ponds.

The discharge is not approved due to salt imbalance problems. Three additional oxidation and percolation ponds will be constructed to alleviate the problem. The sludge digester will also be refurbished and a plant capacity increase is scheduled with the construction of a clarifier and enlarged headworks facilities.

King City has recently completed a new domestic treatment facility with a design capacity of 1.0 million gallons per day. The average flow of 460,000 gallons per day is disposed of by spray irrigation. Treatment facilities include comminution and biological stabilization ponds. This new facility is presently meeting discharge requirements established by the Regional Board.

King City has completed a new industrial waste collection and treatment system in conjunction with its domestic waste facility. The treatment facilities include a biological stabilization pond and spray irrigation disposal system.

The King City Airport treatment facility provides secondary treatment for airport domestic wastes. This facility will be abandoned and flows will be diverted to King City in the near future. Present treatment facilities include grit removal, primary sedimentation, trickling filter, secondary sedimentation and sludge digestion with the effluent discharged to percolation ponds.

There is one domestic treatment system in the San Ardo planning area. The San Ardo Water District constructed a domestic collection and primary treatment facility with land disposal in 1973 serving 1,000 people.

As stated earlier, the alternative screening process revealed these small and widely scattered wastewater treatment and disposal facilities should be retained and upgraded to provide separate water quality control consistent with state and federal guidelines. Treatment necessary for land disposal in this area should be sufficient to control nuisance and prevent groundwater degradation. In some cases new sewage lagoons, or primary facilities with or without oxidation ponds may be acceptable. Upgrading of treatment facilities in this rural area should be based on water quality control needs or other environmental factors. These should be evaluated in project reports for future wastewater improvements.

Nacimiento Region

Twenty-four alternatives for the treatment and disposal of waste loads generated in the Hunter Liggett, San Antonio Lake and Nacimiento areas were identified for the Nacimiento Region. The alternatives range from providing treatment and disposal facilities at each area to total consolidation of flows (except those generated at Hunter Liggett) and a common treatment and disposal facility.

The Hunter-Liggett area includes four domestic waste collection and treatment systems. One system serves the headquarters area. Two other systems are located in bivouac areas and the fourth system treats waste from Mission San Antonio.

The existing headquarters treatment facility consists of new aerated lagoons and a spray irrigation disposal system. This facility is currently in compliance with discharge requirements established by the Regional Board. The treatment systems in the Alamo and Jolon Bivouac areas consist of septic tanks with discharge to percolation ponds. No problems relative to water quality have been identified with these facilities.

A 30,000 gallon per day primary treatment plant serves the camp grounds on the northern side of the San Antonio Reservoir. The average flow of 6,000 gallons per day is discharged to stabilization ponds.

Preparations have been made for sewering the northern shore of the reservoir to protect the reservoir waters in the event that approximately 15,000 acres are developed for residential use. A new secondary treatment plant and land disposal system would be included in these plans.

A 140,000 gallon per day secondary treatment facility serves the southern portion of the San Antonio Reservoir. The average flow of 25,000 gallons per day is discharged to stabilization ponds with spray disposal facilities available when necessary.

General Resources operates a domestic waste treatment facility at its Oak Shores development at Lake Nacimiento. The system consists of an extended aeration package treatment plant and a spray disposal field. The existing treatment plant is an interim facility which will be replaced when the area is more developed.

No plans presently exist for sewering the Nacimiento Reservoir area during the five-year study period. However, plans for a collection system will be made as soon as the area develops a substantial residential population.

The Nacimiento Region is very hilly and waste load sources are widely separated, in some cases by the two reservoirs. Except for the Hunter Liggett facilities, all developments are used primarily on a seasonal basis (parks and summer home developments). Average daily flows during the summer are approximately ten times the average daily flow during the remainder of the year. It is recommended that a water quality management plan for the region be directed toward providing separate treatment and disposal facilities at each of the waste load sources.

San Luis Obispo Region

Sixty-four alternatives, each of which makes provisions for treatment and disposal of waste loads generated in the Camp Roberts, San Miguel, Paso Robles, Templeton, Atascadero, Garden Farms, Santa Margarita and Shandon areas, were identified for the San Luis Obispo Region. The alternatives range from providing treatment and disposal facilities at each area to total consolidation of flows generated in the region and a common treatment and disposal facility.

The California National Guard operates a secondary treatment facility at Camp Roberts. This treatment plant which was built in 1941 is presently being refurbished. Treatment consists of comminution, primary sedimentation, biological filtration, secondary filtration, chlorination, sludge digestion and disposal to percolation ponds. No information is available on the quality of the influent or effluent.

The San Miguel Sanitary District operates a primary treatment facility. The system was rated at a design capacity of 300,000 gallons per day when new; however, it has since deteriorated. The average flow of 60,000 gallons per day approaches the capacity. Lagoons are being constructed to increase the capacity of the system. The waste would then be disposed of by agricultural irrigation or by means of percolation and evaporation ponds.

The City of Paso Robles provides a 1.0 million gallon per day secondary treatment plant. The average flow of 900,000 gallons per day is discharged to stabilization ponds and then to the Salinas River. Additional treatment facilities are now under construction which will provide for normal growth and the addition of waste from Templeton Sanitary District when the collection system is completed in 1974-75.

There are no existing domestic wastewater collection and treatment facilities within the Templeton planning area. A collection system and interceptor to the Paso Robles treatment plant is scheduled for the Templeton Sanitary District. The wastewater will then be treated and discharged to percolation and evaporation ponds.

The Atascadero County Sanitation District operates a secondary treatment plant with a design capacity of 300,000 gallons per day. The average flow of 70,000 gallons per day is discharged to stabilization ponds. New percolation ponds are scheduled and extended aeration treatment units will be used to increase capacity.

The Atascadero State Hospital operates a 500,000 gallon per day secondary treatment facility. The average flow of 210,000 gallons per day is discharged to percolation ponds.

The Santa Margarita School operates a primary treatment plant facility with a design capacity of 10,000 gallons per day. The average flow of 1,500 gallons per day is discharged to subsurface with overflow to ponds. The County Care Hospital operates a 15,000 gallon per day secondary biological treatment facility with chlorination of effluent and leach field disposal. The average flow is 5,000 gallons per day. Plans for Shandon are to construct a collection system, primary treatment plant, and percolation and evaporation ponds.

Alternatives considered involved various levels of consolidation. The recommended wastewater management plan for this region calls for separate treatment and disposal facilities at Camp Roberts, San Miguel, Paso Robles, Atascadero, Santa Margarita School and Shandon. The Shandon project may be financially infeasible in that it would require a local connection charge of $251/connection. Atascadero State Hospital can be served more economically by the Atascadero C.S.D. facility.

CARMEL RIVER SUB-BASIN

Four areas within the Carmel Region produce waste loads. There are the Carmel Sanitary District, Carmel, Carmel Valley and Carmel Highlands.

The Carmel Sanitary District contains one domestic wastewater collection and treatment system. Wastewater from the Pebble Beach planning area is transported to the Carmel Sanitary District treatment plant for treatment and disposal.

The Carmel Sanitary District operates a secondary treatment plant with a design capacity of 2.0 million gallons per day. The average flow of 1.1 million gallons per day is discharged to Carmel Bay through a 600 foot outfall at a depth of 40 feet. Treatment facilities include comminutor, grit chamber, clarifiers, aeration basins and separate sludge digesters. Two flow proportional V-notch chlorinators provide post-chlorination at a dosage rate of 27 to 30 ppm. The treatment facility was completed in 1972 and currently meets discharge requirements.

The Carmel Highlands Property Owners, a number of private homes and a motel in the Carmel Highlands area, are presently connected to a single line which discharges to the surf from a cliff. A common septic tank with chlorination facilities has been constructed to treat the wastewaters before discharging to the ocean in order to comply with the waste discharge requirements as set by the Regional Board. Because of land restrictions in the Highlands area, waste flows will have to be conveyed to treatment facilities in other areas.

The Carmel Highlands area between San Jose and Malpaso Creeks is scheduled for the construction of a collection system, lift stations and a force main to the Carmel Sanitary District for treatment and disposal to either Carmel Bay or a reclamation project in Carmel Valley. Although the assessed valuation in this area is quite high, the rugged terrain will make the construction of a wastewater system extremely expensive. Many homes will require individual lift stations if they are to use a public sewer system. These difficult conditions have prevented any serious consideration of sewering this area until recently.

Another major unsewered area within this sub-basin is Carmel Valley. Development is now occurring very rapidly but tends to be concentrated in widely scattered pockets. This situation will make the construction of a regional sewer system quite expensive. However, construction has now been planned for a collection system, lift stations, and a force main to the Carmel Sanitary District where the wastewater will be treated and disposed of either through an outfall to Carmel Bay or a new reclamation project which would recharge the groundwater in Carmel Valley. As an alternative, interim solution one or more extended aeration package treatment plants could be constructed in the Valley itself. This would eliminate a portion of the cost for an interceptor to the Carmel Sanitary District and would keep the water in Carmel Valley for groundwater recharge. Six alternatives ranging from providing treatment and disposal at each waste source to total consolidation of the waste loads at a common treatment and disposal facility have been identified for the Carmel Region. Four alternatives are presented in Table 16-20. These include two regional alternatives, remaining after preliminary screening based on costs, and one interregional alternative.

Alternative I maintains individual treatment facilities at Carmel, Carmel Valley and Carmel Highlands with disposal of effluent by land spraying. The Carmel Sanitary District could continue to utilize an outfall to Carmel Bay. Alternative IIA consolidates all flows from the Carmel Region at the Carmel Sanitary District and provides secondary treatment and disposal through an outfall into Carmel Bay. Alternative IIB provides for treatment to level VIII.

Alternative III would transport the waste loads generated in the Carmel Sanitary District and the Highlands area to Monterey for treatment and disposal to the ocean off Pt. Pinos.

The costs of the alternatives are shown in Table 16-20. The costs presented indicate that the least costly solution for Carmel is to maintain separate treatment and disposal facilities. The incremental cost to Carmel of exporting its wastewater to Monterey for treatment and disposal is much greater than the other alternatives.

MONTEREY COASTAL SUB-BASIN

The Monterey Coastal Sub-basin includes two waste load sources, Point Sur Naval Facility and Pfeiffer Big Sur State Park. Only two alternatives have been identified for this region. The Point Sur Naval Facility and Big Sur State Park can either maintain their existing facilities or consolidate their flows at Big Sur with a common treatment and disposal facility or a wastewater reclamation facility.

The U.S. Navy operates a 20,000 gallon per day extended aeration package treatment plant at Point Sur. The average flow of 12,000 gallons per day is discharged to the ocean through an outfall. One flow proportional V-notch chlorinator has recently been added to provide post-chlorination.

The Pfeiffer Big Sur State Park operates a 100,000 gallon per day extended aeration package treatment plant to serve the shops and camping facilities. The average flow of 50,000 gallons per day is discharged to a subsurface leach field. The park facility is presently experiencing problems with the surfacing of effluent from the subsurface leach field. A spray disposal system is scheduled for construction in 1974-75.

The community of Big Sur has no plans to provide a collection system for wastewater in the near future since existing septic tanks are adequate.

Based on costs it appears that a water quality management plan should be oriented toward maintenance of separate treatment and disposal facilities at Point Sur Naval Facility and Pfeiffer Big Sur State Park. The reclamation potential is

Table 16-20. Cost of Carmel Regional Alternatives, Thousands of Dollars

Alternative	Description	Capital		O & M		Present worth
		1975	1985	1975	1985	
I	Individual secondary treatment facilities	635	491	237	308	4,833
IIA	Consolidate all flows at Carmel CSD and provide secondary treatment and ocean disposal	1,993	400	185	224	5,333
IIB	Consolidate all flows at Carmel CSD and provide treatment Level 8	5,238	1,887	605	755	16,654
III[a]	Consolidate Monterey and Carmel flows at Monterey and provide secondary treatment and ocean disposal	12,289	553	-	-	18,412

[a] Incremental cost to Carmel region.

considered to be negligible due to the very small waste loads that are projected for these sources.

SAN LUIS OBISPO COASTAL SUB-BASIN

The San Luis Obispo Coastal Sub-basin encompasses the coastal area of San Luis Obispo County southwest of the Santa Lucia Mountains and extends as far south as the watershed divide with the Santa Maria River. Because of the size and configuration of the sub-basin, it was divided into four study areas: the North Coast Region, the Morro Bay Region, the San Luis Obispo Creek Region and the South County Region.

North Coast Region

The North Coast Region is composed of the San Carpoforo, Arroyo de la Cruz, San Simeon and Santa Rosa hydrologic subareas. There are presently three dischargers of municipal wastewater in the region: the first is the San Simeon Acres Community Services District which serves the community of San Simeon Acres plus the San Simeon County Park and the Hearst San Simeon State Historical Monument; the second is the Cambria County Water District which serves the community of Cambria and the third is the Cambria Air Force Radar Station. Waste loads are also imposed on the receiving waters of the region by about 1,360 acres of irrigated agriculture, by low density cattle grazing and by many isolated individual domestic waste disposal systems.

San Simeon Acres

The San Simeon Acres WTP provides secondary treatment by means of the activated sludge process and has an average dry weather flow (ADWF) capacity of 0.15 mgd. One third of that capacity has been purchased by the State of California to serve the William R. Hearst Memorial State Beach and the Hearst San Simeon State Historical Monument. The plant was originally constructed in 1964-65 as a 0.05 mgd plant and was enlarged to its present capacity in 1971-72. Present summer flows to the plant, which do not include the State Park and Historical Monument, average about 0.05 mgd.

Treatment plant facilities include a communitor, three duplicate aeration tanks, three duplicate secondary sedimentation tanks, a chlorine contact tank, a sludge holding tank, and an administration building containing a laboratory, an equipment room, and a chlorination room.

During low flows, which occur for more than eight months of the year when the tourist wastewater load is not placed on the plant, the system can be operated in the extended aeration mode. This operation requires minimal operation and a minimal amount of sludge is produced. During the tourist season, however, as flows increase, the plant must be operated in the conventional activated sludge mode which requires skilled operation and laboratory control and which requires that sludge be periodically wasted to the 16,000 gallon sludge holding tank. As the sludge holding tank is filled to capacity, the contents are emptied into a tanker and trucked to a land disposal site.

Treated effluent flows by gravity to an 8-inch concrete mortar lined corrugated steel ocean outfall. The outfall is 840 feet long and terminates as an open-ended 8-inch pipe at a depth of 22 feet (MSL). The calculated gravity flow capacity of the outfall is about 0.75 mgd. At the present ADWF of 0.05 mgd, wastewater discharged from the outfall during the summer is initially diluted by a factor of less than 30 to 1 with seawater.

Wet weather infiltration and direct storm inflow to the collection system are presently not excessive and total about 1,060 gad. This amount of stormwater inflow is consistent with modern sewer design and construction practices.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the aeration tanks. Because of this, grit settles out in the aeration tanks, reducing their capacity.

2. No facilities are available to either aerobically or anaerobically digest excess sludge wasted from the process during periods of peak loading.

3. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality during the tourist season.

4. An auxiliary power supply is not available.

5. The treatment plant has only one operator and is thus unattended a significant portion of the time.

The San Simeon Acres WTP ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State Water Quality Control Plan for Ocean Waters of California. Computer simulation of the performance of the outfall indicates that the discharge will not meet the 100 to 1 initial dilution required by the State's Ocean Plan. The Plant will require much closer effluent quality monitoring and increased reliability to meet the stringent effluent quality requirements of the plan. The impact of in-home jewelry making in the community on the effluent heavy metals concentrations should be assessed. Possibly source control of these constituents will be necessary. Because the District did not file a Technical Report on its ocean discharge as required by the State's Ocean Plan, insufficient data are available to determine compliance with that plan.

The Cambria County Water District

The Cambria County Water District treatment plant is a 'packaged unit' that can operate as either an extended aeration or a contact stabilization activated sludge process. The unit has a design capacity of 0.25 mgd. After secondary treatment, the wastewater is chlorinated and pumped into one of two 300,000 gallon holding ponds. Plans call for each holding pond to be pumped on alternate days to a spray irrigation disposal area. Thus as one holding pond is being pumped the other is receiving treated effluent. At the present time, percolation of treated effluent through the walls and bottom of the ponds significantly reduces the amount of effluent that must be disposed of by spray irrigation. The District has a 55 KW portable generator which can be used to operate the plant during power failures.

The plant and the two holding ponds were constructed on a compacted earth fill with a surface elevation of 23 feet, about 1.5 feet above the calculated water level in Santa Rosa Creek during a peak discharge with a recurrence interval of 100 years. No protection of the fill from scouring by flood waters was provided.

The spray irrigation area consists of about 8.5 acres including a portion of the flood plain along Santa Rosa Creek and an alternate area on the hillside above the plant. A spray irrigation test of the area conducted in 1967 and percolation tests of the area conducted in 1971 showed that the area could accept about 160,000 gallons per day. The spray irrigation area is separated from Santa Rosa Creek by a small dike. The crest elevation of the dike is 18 feet, one foot above the calculated water level in Santa Rosa Creek during a peak discharge with a recurrence interval of 10 years. No protection of the dike from scouring by flood waters was provided.

The Cambria collection system has reportedly been designed with sufficient capacity to accommodate the ultimate flows from the service area. The system contains several pumping stations which are designed to handle twice the flows from existing development. These pumping stations lack the reliability of an adequately designed and properly operated permanent pumping station.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the aeration tanks. Because of this, grit settles out in the aeration tanks, reducing their capacity.

2. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality. Only one unit is available for each process.

3. The treatment plant has only one operator and is thus unattended a significant portion of the time.

The Cambria County Water District WTP is required to meet discharge requirements promulgated by the Regional Board in 1967. The District is presently in compliance with those requirements.

Cambria Air Force Station Family Housing Unit

Wastewater influent to the Cambria Air Force Station Family Housing Unit WTP receives secondary treatment in an extended aeration unit with a design capacity of 9,300 gpd. Treated effluent flows through a slow sand filter and is chlorinated prior to discharge to Santa Rosa Creek.

Plans by the Air Force and the Cambria County Water District call for the Housing Unit WTP to be abandoned and the homes connected to the latter system when the Lodge Hill area of Cambria is sewered. The Housing Unit WTP is too small to be effectively and economically operated and its abandonment is in the best interests of sound water quality control.

Cambria Air Force Radar Station

The Cambria Air Force Radar Station is located about 3 miles south of Cambria on a bluff overlooking the Pacific Ocean.

Wastewaters flow by gravity to two 10,000 gallon septic tanks operated in parallel. Septic tank effluent then flows to two slow sand filters with a bed surface area of 225 square feet each. Filter media consists of 1.5 feet of 1-inch gravel covered with a 3-foot layer of sand. No disinfection facilities are available. Sand filter effluent flows by gravity to an open-ended outfall and terminates about 60 feet from shore at a depth of about 6 feet (MSL).

The capacity of the Radar Station collection system, treatment unit and ocean outfall are sufficient for present wastewater flows. The Air Force has no plans to substantially increase number of personnel employed at the Radar Station and, thus, the present wastewater collection, treatment and disposal system should need no enlargements in the foreseeable future.

Alternative Municipal Wastewater Management Plans – North Coast Region

Alternative plans involving degrees of consolidation of treatment and disposal function, ocean disposal and land disposal by spray irrigation and percolation have been investigated. Utilizing the assessment of environmental sensitivity, two basic alternatives each of which contains several sub-alternatives, and a no action alternative have been developed: Alternative I consists of the consolidation of two existing dischargers at an enlarged and upgraded WTP at Cambria with either land or ocean disposal; Alternative II consists of enlarging and upgrading the existing treatment and disposal facilities with either land or ocean disposal.

No Action Alternative. The no action alternative consists of not upgrading or enlarging the capacity of existing conveyance, treatment and disposal facilities. With this option, the deficiencies of the existing systems would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability will decrease and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped, or significantly curtailed, and the current means of wastewater management with its deficiencies continued.

Alternative I. Alternative I consists of the conveyance of untreated wastewater from San Simeon Acres to an enlarged and upgraded regional WTP at Cambria. Cambria is now and will probably continue to be the largest community in the region. Conveyance costs thus favor the location of any regional treatment facility near that community. The existing treatment plant at San Simeon Acres will be converted to a pumping station. A second pumping station will be provided near the San Simeon State Beach which would convey the combined flow from the William R. Hearst San Simeon State Historical Monument (now being conveyed to the San Simeon Acres WTP), San Simeon State Beach, and San Simeon Acres Community Services District to Cambria. Because of public health hazards which exist at present, it is assumed that the Cambria County Water District will be completely sewered by the time this alternative would be implemented and the existing discharge from the Cambria Air Force Station Family Housing Unit will have been eliminated.

Preliminary investigations revealed that the conveyance of wastewaters from the Cambria Air Force Radar Station proper to a regional WTP in Cambria would be very uneconomical and without any overriding functional or environmental benefit. Both alternatives for the Cambria Air Force Radar Station thus involve local treatment and disposal.

Because the combined wastewater flow from the public dischargers will far exceed the capacity of the existing package WTP at Cambria, for this alternative it is assumed that a new regional WTP will be constructed. Treatment appropriate to either ocean or land disposal will be provided. Disposal to Santa Rosa Creek is not considered an acceptable option because of the environmental sensitivity of the lagoon at the Creek's mouth. For the Cambria Air Force Radar Station, acceptable disposal options include ocean disposal, spray irrigation and percolation. Because of the high cost of an adequately designed ocean outfall, ocean disposal was not considered an acceptable disposal option for the Radar Station.

Land disposal by either spray irrigation or percolation will require biological secondary treatment.

Acceptable treatment levels for ocean disposal include primary sedimentation with chemical addition or biological secondary treatment plus disinfection and dechlorination. For planning purposes it is assumed that ocean disposal for the regional system will occur through an ocean outfall with a multiport diffuser starting at 1,000 feet offshore of the 35-foot depth contour.

Continuation of ocean disposal at the radar station will require that its ocean outfall be extended to the 35-foot depth and a multiport diffuser provided. Additionally, the Radar Station's treatment facility will need minor upgrading and the addition of disinfection and dechlorination facilities. Because preliminary estimates of the total annual costs of ocean disposal for the radar station indicated that ocean disposal would be about 10 times as expensive as land disposal, consideration of ocean disposal was not carried further.

The facilities required to implement this alternative are shown in Fig. 16-7. Preliminary cost estimates narrowed the financially feasible disposal options to ocean disposal and percolation for the regional system and percolation and spray irrigation for the Radar Station. The estimated project costs of the facilities required for this alternative are given in Table 16-21.

Alternative II. Alternative II consists of upgrading and enlarging the existing wastewater treatment plants at San Simeon Acres Community Services District, at Cambria County Water District and at the Cambria Air Force Radar Station. Either land disposal by percolation or ocean disposal are appropriate disposal options for the first two dischargers. Land disposal by either percolation or spray irrigation with storage is appropriate for the Radar Station. Feasibility level studies indicate that ocean disposal at San Simeon Acres should occur through an ocean outfall with a multiport diffuser commencing at the 35-foot depth contour. Ocean disposal offshore of the State Park beach at Cambria should occur through an ocean outfall with a multiport diffuser commencing at 1,000 feet offshore of the 35-foot depth contour. The improvements required to implement this alternative for year 2000 flows are illustrated in Fig. 16-7. As in Alternative I, the spray irrigation with storage option for Cambria and San Simeon Acres and the ocean disposal option for the Radar Station were dropped from detailed consideration because of excessive cost. The estimated project costs of the facilities required for this alternative are given in Table 16-21.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to export wastewaters to a neighboring sub-basin, plans involving discharge to San Simeon or Santa Rosa Creek, etc.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water include agriculture, recreation and land beautification, domestic use, streamflow augmentation and groundwater recharge. Potential reuses which are particularly promising and which should be investigated at the project planning level include agriculture, golf course irrigation, streamflow augmentation and groundwater recharge.

Comparison of Alternatives — North Coast Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the recommended plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-21. Capital costs are the sum of the cost of an initial construction stage expected to occur on or before 1975-76 and a second construction stage expected to occur in 1985-86. Total annual costs include amortized capital costs of both stages and the operation and maintenance costs expected to occur in 1990 when the average flow for the study period is expected to occur. Present worth is computed for all costs (including operating costs) expected to occur between 1975 and 2000.

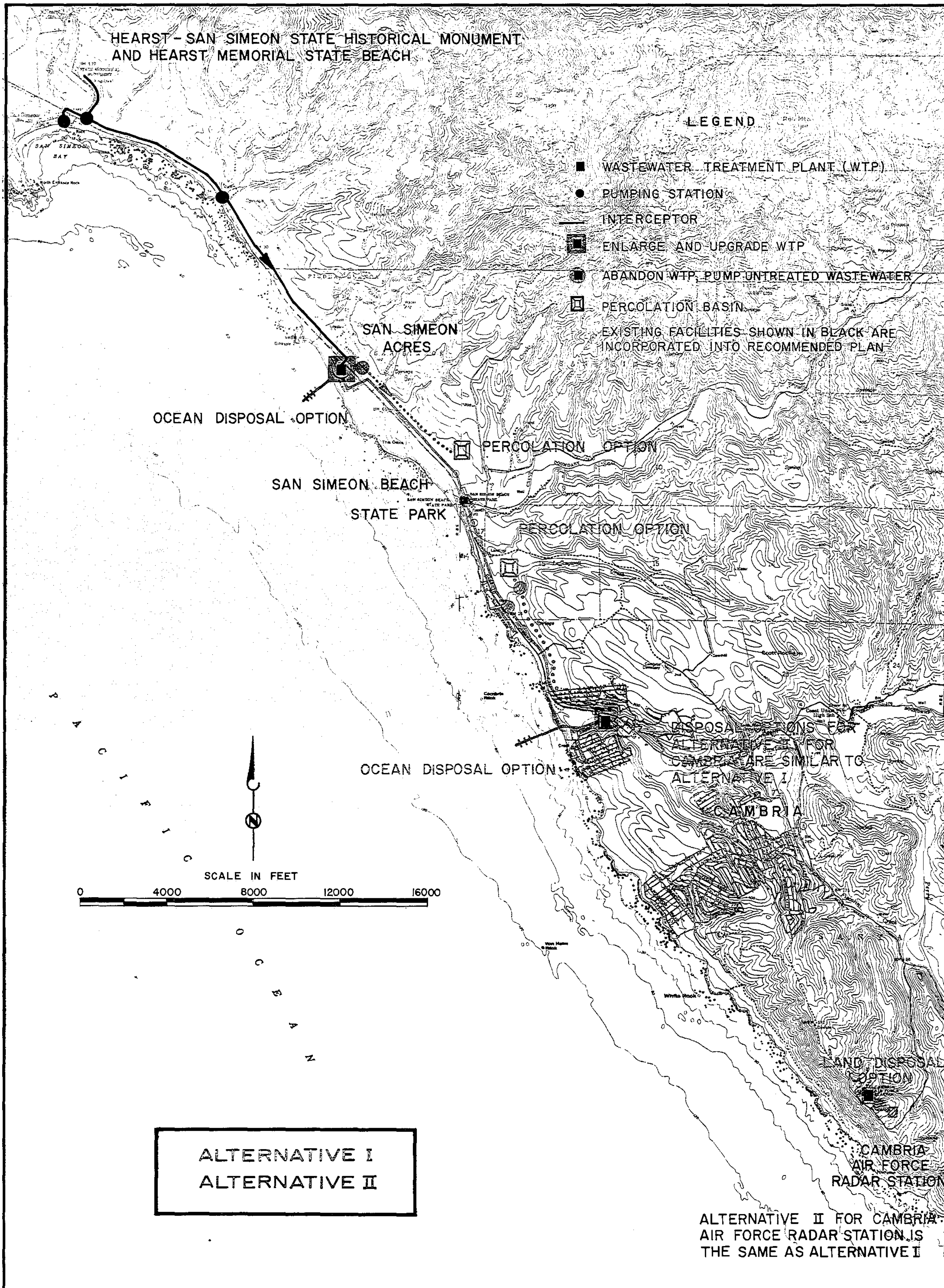


Fig. 16-7 Alternative Municipal Wastewater Management Plans
San Luis Obispo Coastal Subbasin
North Coast Region

Table 16-21. Evaluation of Economic Factors of Alternatives, North Coast Region, Thousands of Dollars[a]

Factor service Area	Alternative I		Alternative II	
	Ocean disposal	Percolation	Ocean disposal	Percolation
Capital cost[b]				
San Simeon Acres Community Services District	2,100	2,000	1,100	900
Cambria County Water District	1,600	1,400	1,900[e]	1,500
Cambria Air Force Radar Station	NA	100[d]	NA	100[d]
Total	3,800[c]	3,500	3,100[c]	2,500
Total annual cost				
San Simeon Acres Community Services District	190	180	130	110
Cambria County Water District	170	150	200	180
Cambria Air Force Radar Station	NA	10[d]	NA	10[d]
Total	370[c]	340	340[c]	300
Present worth				
San Simeon Acres Community Services District	2,200	2,100	1,500	1,300
Cambria County Water District	2,000	1,800	2,300	2,100
Cambria Air Force Radar Station	NA	200[d]	NA	200[d]
Total	4,400[c]	4,100	4,000[c]	3,600
Initial local annual financial burden				
San Simeon Acres Community Services District	50	50	50	40
Cambria County Water District	70	70	80	70
Cambria Air Force Radar Station	NA	10	NA	10
Total	130[c]	130	140[c]	120

NA = not applicable

[a]Costs based on an ENR construction cost index of 2000.
[b]Costs of staged construction of facilities required to meet projected wastewater demands until the year 2000.
[c]Totals for ocean disposal include spray irrigation with storage for the Cambria Air Force Radar Station.
[d]All costs for spray irrigation with storage are equal to the costs for percolation for the Cambria Air Force Radar Station.
[e]Based on secondary treatment. Capital cost with primary sedimentation plus chemical addition would be $100,000 less; annual cost would be $10,000 less.

For a facility whose useful life extends beyond the year 2000, present worth of the capital value is taken as the present worth of the series of annual costs to the year 2000.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of design average dry weather flow in each specific facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

The alternative having the least total capital and total annual costs is Alternative II. Based on cost alone, therefore, some form of local or subregional treatment and disposal is preferable to alternatives which involve regional wastewater transport. Feasibility level estimates indicate that a form of land disposal is the most economical disposal option for the Cambria Air Force Radar Station. For San Simeon Acres Community Services District and Cambria County Water District, feasibility level estimates indicate that total annual costs for ocean disposal and disposal to percolation basins are essentially the same. The costs of land disposal are very sensitive to land costs, the distance of the land disposal site from the service area and energy costs for pumping. Project level studies of soil infiltration rates and other constraints to the location of percolation basins will be necessary to firmly establish the economics of land and ocean disposal options.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-22.

Based on functional factors, Alternative II is preferable to the other Alternatives. The overall ratings for both disposal options considered technically and economically feasible for San Simeon Acres and Cambria Radar Station are equal. For Cambria, the land disposal option which utilizes percolation is favored, mainly because it appears likely to receive greater public and local government acceptance and support.

Morro Bay Region

Municipal discharges in the Morro Bay Region include the City of Morro Bay, Cayucos Sanitary District, the California Mens Colony (U.S. State Correction Facility), the presently unsewered Los Osos—Baywood Area, (County Service Area Number 9), and a boarding school operated by San Luis Obispo County.

Morro Bay—Cayucos

Wastewater generated in the City of Morro Bay and the Cayucos Sanitary District is given secondary treatment at the Morro Bay—Cayucos Wastewater Treatment Plant (WTP). The treatment facility consists of two high rate biofiltration plants operated in parallel. Plant Number 1 was built in 1954 and has a design capacity of 0.7 mgd and Plant Number 2 was constructed in 1964 with a design capacity of 1.0 mgd. In 1972, the summer ADWF was about 1.15 mgd and the total contributing permanent resident population was about 10,000.

The ocean outfall consists of about 530 linear feet of 18-inch vitrified clay pipe and about 1,230 linear feet of 16-inch Schedule 40 steel pipe. It terminates about 700 feet offshore at a depth of 45.0 feet (MSL). An approximately 4-foot long section of 16-inch pipe is connected to the end of the outfall and terminates vertically, directing the effluent toward the ocean surface. The reported capacity of the outfall is 4.6 mgd at maximum high tide. The calculated gravity flow capacity of the outfall is about 2.8 mgd. A computer simulation of outfall performance indicates that at a flow of 1.15 mgd, the effluent is initially diluted by less than 2 to 1 with seawater by the time it reaches the water surface. This dilution does not meet the 100 to 1 dilution required by the State's Ocean Plan.

The Cayucos and Morro Bay collection systems allow excessive infiltration and direct storm inflow during wet weather. It is not possible to calculate an approximate rate of stormwater inflow to the system because the flow to the treatment plant surcharges during high flows.

In addition to the above problems the existing plant has certain deficiencies which should be corrected. Those deficiencies are summarized as follows:

1. The wet/dry well that serves the influent pumping station is unsafe according to the criteria

Table 16-22. Evaluation of Functional Factors of Alternatives, North Coast Region

Service area/factor	No action	Alternative I: Ocean disposal	Alternative I: Percolation	Alternative I: Spray irrigation with storage	Alternative II: Ocean disposal	Alternative II: Percolation	Alternative II: Spray irrigation with storage
San Simeon Acres Comunity Services District							
Effectiveness	Poor	Marginal	Marginal	NA	Excellent	Excellent	NA
Reliability	Poor	Adequate	Adequate	NA	Excellent	Adequate	NA
Flexiblilty	Marginal	Marginal	Marginal	NA	Excellent	Excellent	NA
Implementation	Poor	Marginal	Marginal	NA	Adequate	Adequate	NA
Reclamation Potential	Marginal	Marginal	Marginal	NA	Adequate	Excellent	NA
Compatibility	Poor	Excellent	Excellent	NA	Adequate	Adequate	NA
Overall Rating	Poor	Marginal	Marginal	NA	Excellent	Excellent	NA
Cambria County Water District							
Effectiveness	Poor	Excellent	Excellent	NA	Excellent	Excellent	NA
Reliability	Poor	Adequate	Adequate	NA	Excellent	Adequate	NA
Flexibility	Marginal	Adequate	Adequate	NA	Excellent	Excellent	NA
Implementation	Poor	Adequate	Adequate	NA	Marginal	Excellent	NA
Reclamation Potential	Marginal	Adequate	Excellent	NA	Adequate	Excellent	NA
Compatibility	Poor	Excellent	Excellent	NA	Adequate	Adequate	NA
Overall Rating	Poor	Adequate	Adequate	NA	Adequate	Excellent	NA
Cambria Air Force Radar Station							
Effectiveness	Poor	NA	Excellent	Excellent	NA	Excellent	Excellent
Reliability	Poor	NA	Excellent	Excellent	NA	Adequate	Adequate
Flexibility	Marginal	NA	Excellent	Excellent	NA	Excellent	Excellent
Implementation	Poor	NA	Excellent	Excellent	NA	Adequate	Adequate
Reclamation Potential	Marginal	NA	Adequate	Adequate	NA	Excellent	Excellent
Compatibility	Poor	NA	Adequate	Adequate	NA	Adequate	Adequate
Overall Rating	Poor	NA	Excellent	Excellent	NA	Excellent	Excellent

established by the National Occupational Health and Safety Act.

2. The plant is not equipped with grit removal facilities and as a consequence all grit which is deposited in the primary sedimentation tank is pumped to the digesters, reducing their capacity.

California Men's Colony

The California Men's Colony, a state correctional facility, is located about six miles northwest of San Luis Obispo on the eastern portion of the former Camp San Luis Obispo. The State of California took over the operation of the wastewater treatment plant and the water filtration plant at Camp San Luis Obispo from the United States Army in 1961. The water and sewerage facilities serve the various entities located inside the former United States Army facility. They include the California Men's Colony, the California National Guard, the San Luis Obispo County Operational Facility, Cuesta College and the United States Forest Service. The existing service area includes about 730 acres.

The treatment plant provides secondary treatment by means of four biological trickling filters and has a design capacity of 2.0 mgd. Wastewater flows by gravity through a mechanical bar screen a comminuting device and continuously recording flow meter. Primary treatment occurs in two rectangular sedimentation tanks operated in parallel.

Portions of the plant's effluent are used for agricultural irrigation and catfish farming by the California Polytechnic University on lands north of the plant site. The remainder of the flow is discharged to Chorro Creek about five miles upstream of Morro Bay. Current plans by the Men's Colony call for the construction of an oxidation-percolation pond adjacent to the plant site to receive plant effluent.

The wastewater collection system was sized to accommodate the wastewater from a military population of 25,000. It is unlikely that the capacity of the existing collection system will be exceeded in the foreseeable future.

An analysis of wet weather flows similar to the analyses presented in Chapter 5 revealed that during wet weather up to 670 gad is contributed to the system bywet weather infiltration. During heavy rains the flow to the plant often exceeds the capacity of the flow meter, (3.0 mgd) indicating that direct inflow may be as high as three times the amount of infiltration. This stormwater inflow rate is in excess of those consistent with modern sewer design and construction practices.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. An auxiliary power supply is not available.

2. Duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality. A single secondary sedimentation tank and a single chlorinator are available.

3. The plant is not equipped with grit removal facilities and, as a consequence, all grit which is deposited in the primary clarifiers is pumped to the digesters.

4. The plant is not adequately protected from flooding by Chorro Creek. Flood protection and effluent pumping facilities are needed.

The California Men's Colony WTP is required to meet discharge requirements promulgated by the Regional Board in 1969. It is presently in compliance with those requirements.

County Service Area 9

County Service Area 9 was recently formed to assume the ownership, operation and maintenance of the sewerage system of Vista de Oro Subdivision. The Vista de Oro Subdivision consists of 70 dwellings located in the unincorporated community of Baywood Park. Wastewaters are collected and transported to a septic tank with a reported capacity of 21,000 gpd and disposed of by subsurface leaching on a designated land disposal area. County Service Area 9 is required to meet discharge requirements promulgated by the Regional Board in 1971. The discharger is in compliance with those requirements.

San Luis Obispo County Schools

The San Luis Obispo County Schools operate a county boarding school approximately five miles northwest of San Luis Obispo on the north side of Highway 1 adjacent to Pennington Creek. Presently, wastewaters are treated in septic tanks designed to receive 22,500 gallons per day from a population of 150 persons and disposed of in a leach field. The ADWF from the school was 3,000 gallons per day in 1971. Plans call for connection to the California Men's Colony WTP. This action is in the best interest of water quality control.

Alternative Wastewater Management Plans — Morro Bay Region

Alternative plans involving degrees of consolidation of treatment and disposal functions, ocean disposal, land disposal by spray irrigation or percolation and stream disposal have been investigated. Utilizing the assessment of environmental sensitivity, three basic alternative plans, each of which contains several sub-alternatives, and a no action alternative were developed: Alternative I would consolidate existing dischargers at the upgraded and enlarged Morro Bay — Cayucos WTP with ocean disposal; Alternative II would consolidate existing dischargers at a new inland regional WTP with either stream or land disposal; and Alternative III calls for enlarging and upgrading existing WPT's and either sewering the Los Osos-Baywood area or limiting population density and leaving it unsewered.

No Action Alternative. The no project alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal system. With this option, the deficiencies of the existing systems would not be corrected. If flows to the existing systems are allowed to increase, overload conditions will develop, reliability will decrease and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. As population growth in the Los Osos-Baywood area continues unchecked, the quality of drinking water pumped from the same areas that are now accepting septic tank effluents may deteriorate. Alternatively, the growth of population and economic development of the areas could be stopped or significantly curtailed and the current means of wastewater management, with its deficiencies, continued.

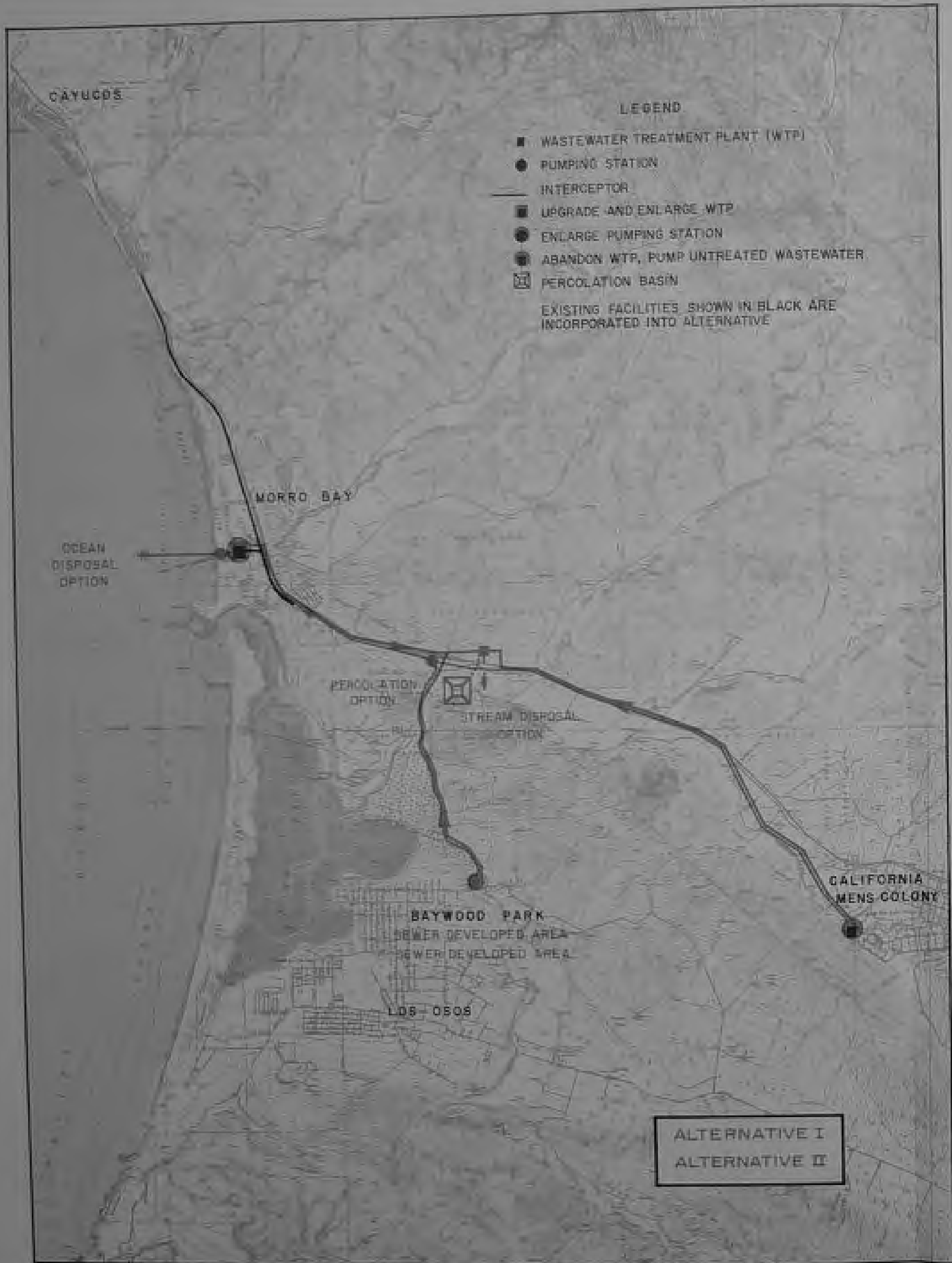
Alternative I. Alternative I consists of sewering Los Osos-Baywood, in accordance with the 1980 prohibition of individual disposal systems, abandoning the existing California Men's Colony WTP and conveying the untreated wastewater from those two areas to the existing Morro Bay-Cayucos WTP. The Morro Bay-Cayucos WTP would be upgraded and enlarged and disposal of treated wastewater would be accomplished by ocean disposal through an ocean outfall with a multiport diffuser commencing at 1,000 feet offshore of the 35-foot depth contour. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-8. The estimated costs of the facilities required for this alternative are given in Table 16-23.

Alternative II. Alternative II is similar to Alternative I except untreated wastewaters from all dischargers would be conveyed to a new regional WTP in Chorro Basin with disposal to either Chorro Creek or to percolation basins.

It is assumed that discharge to Chorro Creek near to its entrance into Morro Bay will require physical-chemical-biological treatment with nutrient removal, effluent filtration, disinfection and dechlorination and storage facilities to preclude bypasses of poorly treated wastewater.

Feasibility level studies have indicated that it may be possible to dispose of treated wastewater in percolation basins near the mouth of Chorro Creek, downstream of the water wells which provide a portion of the City of Morro Bay's municipal water supply. Although project level soils and hydrogeological studies would be necessary to establish the actual feasibility of such a disposal option, it is presented here because such a disposal option might help retard seawater intrusion into the Chorro Creek basin. Because what little soils and geological data that are available suggests that lower infiltration rates are likely to be encountered, a more conservative unit land requirement of 11 acres per mgd for percolation basins is assumed. Land disposal using percolation basins in this area will require level V treatment (biological oxidation plus denitrification). The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-8. The estimated project costs of the facilities required for this alternative are given in Table 16-23.

Alternative III. Alternative III consists of no consolidation of sewerage facilities. With this alternative, the Morro-Bay Cayucos WTP would be enlarged and upgraded with either ocean disposal or disposal to percolation basins in Chorro Creek Basin. A third disposal option consisting of a combination of disposal to a spray irrigation area in the summer and ocean disposal in the winter was investigated, but discarded because the annual cost of such a disposal option was 20 percent more than either total land or total ocean disposal. A wastewater reuse scheme utilizing such a concept, however, may be feasible and should be considered at the project level. For the ocean disposal option, a new ocean outfall would be constructed with a multiport diffuser



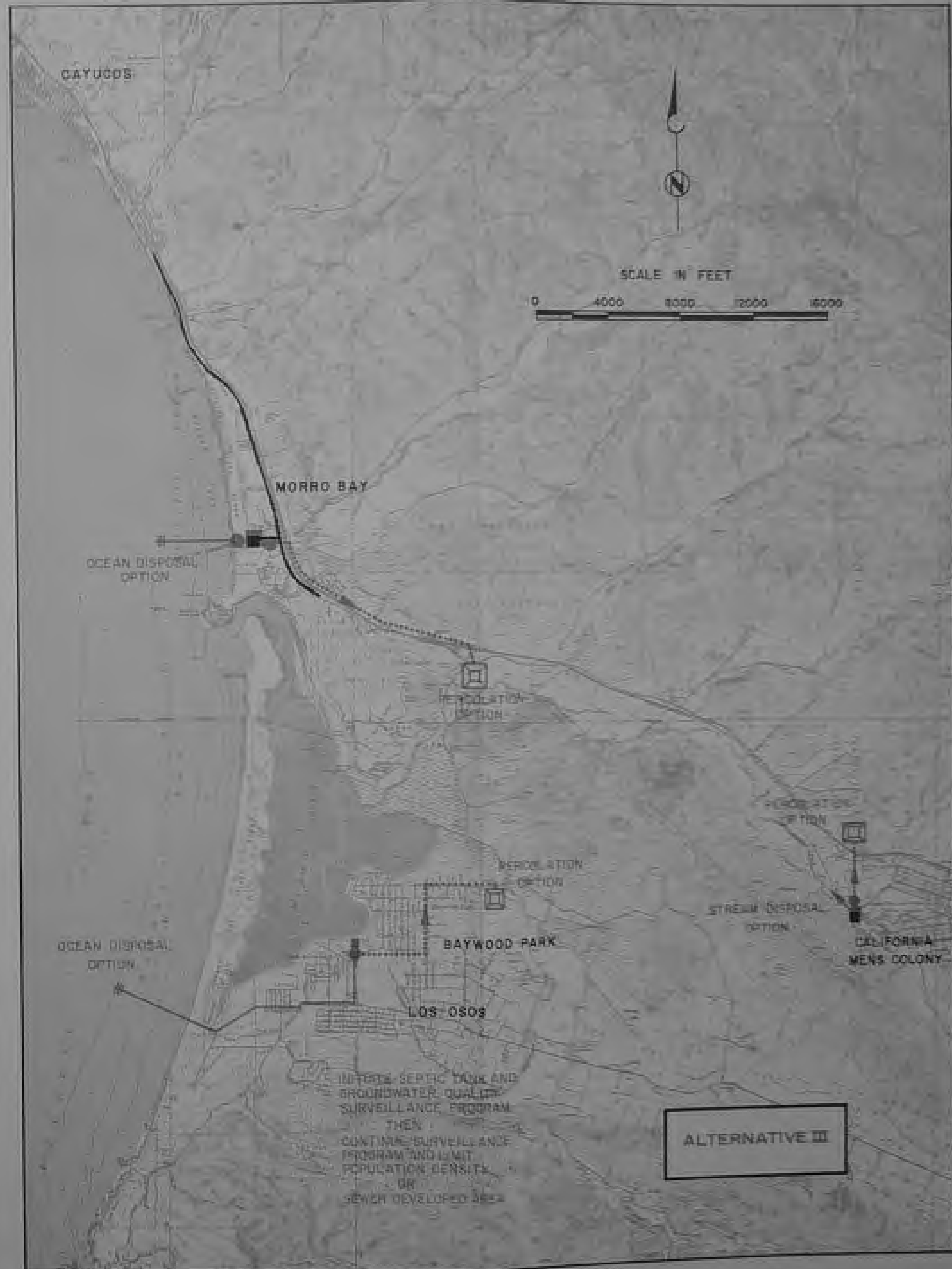


Fig. 16-8 Alternative Municipal Wastewater Management Plans
San Luis Obispo Coastal Subbasin
Morro Bay Region

Table 16-23. Evaluation of Economic Factors of Alternatives, Morro Bay Region, Thousands of Dollars[a]

Factor/service area	Alternative I	Alternative II		Alternative III	
	Ocean disposal	Stream disposal	Percolation	Surface water disposal	Percolation
Capital cost[b]					
Morro Bay-Cayucos	3,700	6,300	5,800	3,800[c]	4,800
California Mens Colony	3,400	3,000	2,900	1,700[d]	1,900
Los Osos-Baywood	5,700	5,500	5,400	6,700[c]	5,600
Total	12,800	14,800	14,100	12,200	12,300
Total annual cost					
Morro Bay-Cayucos	370	750	610	460[c]	570
California Mens Colony	330	320	280	310[d]	250
Los Osos-Baywood	450	460	420	540[c]	480
Total	1,150	1,530	1,310	1,310	1,300
Present worth					
Morro Bay-Cayucos	4,800	8,900	7,500	5,400[c]	6,800
California Mens Colony	3,800	4,000	3,100	3,800[d]	3,100
Los Osos-Baywood	5,400	6,200	6,100	6,600[c]	5,800
Total	14,000	19,100	16,700	15,800	15,700
Initial local annual financial burden					
Morro Bay-Cayucos	170	310	220	200[c]	240
California Mens Colony	110	140	100	190[d]	120
Los Osos-Baywood	120	150	120	170[c]	150
Total	400	600	440	560	510

[a] Costs based on an ENR Construction Cost Index of 2000.
[b] Total cost of staged construction of facilities required to meet projected wastewater demands until the year 2000.
[c] Ocean disposal.
[d] Stream disposal.

commencing at 1,000 feet offshore of the 35-foot depth contour. Biological secondary treatment with disinfection and dechlorination is assumed appropriate for ocean discharge.

For discharge to percolation basins downstream of the municipal water supply well field in Chorro Creek basin, biological secondary treatment with denitrification is considered appropriate. Here, as in Alternative II, a unit land requirement of 11 acres per mgd was assumed. Treated wastewater will be available from the percolation basins for local reuse. The costs of distribution facilities for reclaimed water, however, are not included in the costs of this alternative.

With Alternative III, the California Men's Colony WTP will be upgraded and provided with flood protection and effluent pumping with disposal to either percolation basins or to Chorro Creek. Disposal to percolation basins will require biological oxidation and denitrification (level V treatment). Project level studies should consider spray irrigation as a means to promote seasonal vegetative uptake of nitrogen; under this disposal mode level II treatment may be cost-effective. Disposal to Chorro Creek will require biological oxidation with nitrification, effluent filtration, disinfection and dechlorination (level VI treatment).

The Los Osos-Baywood area, under Alternative III, would be required to initiate a sewerage feasibility program to develop facility requirements necessary to comply with the July 1980 discharge prohibition established for specific sections of this area. It is envisioned that areas requiring sewers would be identified based on present or threatened groundwater degradation or public health hazard. Areas not requiring sewers or where sewers are not cost-effective would be evaluated in terms of alternative control actions including land use and development constraints and septic tank management under a public district. Wastewaters collected in sewers would receive treatment prior to discharge to land or ocean waters.

For disposal by percolation into the porous soils of the area, it is assumed that biological oxidation with nitrification, denitrification (nitrogen removal) and disinfection will be necessary. Ocean disposal will require biological secondary treatment with disinfection and dechlorination. Because of the environmental sensitivity of the near-shore environment, for planning purposes it is assumed that ocean discharge should occur through a multiport diffuser commencing at 1,000 feet beyond the 35-foot depth contour. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-8. The estimated project costs of the facilities required for this alternative are given in Table 16-23.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to discharge wastewater directly to Morro Bay, plans to export wastewater to a neighboring region, plans for ocean disposal for individual small inland dischargers, etc.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water in the Morro Bay Region include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge. Land use plans indicate that a considerable amount of irrigated agriculture will continue to exist in the Morro Bay Region. Presently, wastewater effluent from the California Men's Colony WTP is utilized for irrigation and catfish farming on lands of the California State Polytechnic University adjacent to the WTP. Plans which encourage such reuses should be favored. There are several parks and golf courses in the Morro Bay Region which could be irrigated with reclaimed wastewater. The City of Morro Bay has recently proposed that its effluent be utilized to irrigate parklands and the golf course at the Morro Bay State Park and adjacent farmland in Chorro Basin.

The PGE Morro Bay Power Plant is the only significant industry in the region for which a wastewater reuse potential may exist. The potential for this reuse should be investigated at the project planning level.

It is highly unlikely that direct domestic reuse, which is presently prohibited by the State Department of Health, will be implemented until all sources of new water supply have been exhausted. In the event that planned programs to import water are not implemented or fail to meet the ultimate needs of the area, the first step would be to substitute reclaimed water for the potable supplies now used for agriculture, recreation and land beautification purposes. Only then is consideration likely to be given to the reclamation of wastewater for domestic use. On the basis of present conditions, therefore, it must be concluded that this form of water reuse may not need to be considered in detail for many years.

There are several ephemeral streams in the region which could provide additional riparian habitat with a streamflow augmentation program. This reuse should be investigated at the project planning level. Because of the extensive reliance on groundwater supplies in the region, plans which encourage groundwater recharge for resource augmentation or for the creation of a seawater barrier should be favored.

The previous discussion has indicated that the outlook may be favorable for the reuse of reclaimed water for agriculture, industry, recreation and land beautification, groundwater recharge and streamflow augmentation. These forms of reuse should be considered in detail at the project planning level and alternative plans which encourage their implementation should be favored.

Comparison of Alternatives — Morro Bay Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-28. Capital costs are the sum of the cost of an initial construction stage expected to occur in or before 1975-76 and a second construction stage expected to occur in 1985-86. Total annual costs include amortized capital costs of both stages and the operation and maintenance costs expected to occur in 1990 when the average flow for the study period is expected to occur. Present worth is computed for all costs (including operating costs) expected to occur between 1975 and 2000. For a facility whose useful life extends beyond the year 2000, present worth of the capital value is taken as the present worth of the series of annual costs to the year 2000. The initial local annual financial burden is calculated based on the assumption of 87.5 percent Federal and State grant funding of all project costs other than land with the remaining 12.5 percent (local share) of the capital cost obtained by the sale of 20-year bonds at 6 percent interest plus the annual operating cost in the first full year of project operation. The criteria used in establishing these costs are presented earlier in this chapter.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of design average dry weather flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

The total annual cost of Alternative I is about equal to the total annual cost of Alternative III with surface water disposal for Morro Bay-Cayucos and percolation disposal for Los Osos-Baywood and California Men's Colony. For Morro Bay-Cayucos the cost of percolation disposal with Level IV treatment is about 25 percent higher than the cost of ocean disposal; with Level III treatment, the total annual costs of ocean disposal and percolation disposal are about the same. For the California Men's Colony the total annual cost of stream disposal with level VI treatment is about 25 percent higher than the cost of percolation disposal with level V treatment. The total annual cost of facilities required for percolation disposal of Los Osos-Baywood wastewater is about 10 percent lower than the cost of disposal to the ocean.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the function factors of the alternatives for each service area is presented in Table 16-24. In general Alternative III is rated higher than the first two action alternatives and the no action alternative. The percolation disposal option for Morro Bay-Cayucos encourages wastewater reuse somewhat more than does the ocean disposal option. Studies by the State Department of Water Resources have

Table 16-24. Evaluation of Functional Factors of Alternatives, Morro Bay Region

Service area/factor	No action	Alternative I: Ocean disposal	Alternative II: Stream disposal	Alternative II: Percolation	Alternative III: Surface water disposal	Alternative III: Percolation
Morro Bay-Cayucos						
Effectiveness	Poor	Excellent	Adequate	Adequate	Excellent	Excellent
Reliability	Poor	Excellent	Adequate	Adequate	Excellent	Adequate
Flexibility	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate
Implementation	Poor	Excellent	Marginal	Marginal	Excellent	Excellent
Reclamation potential	Marginal	Adequate	Excellent	Excellent	Adequate	Adequate
Compatibility	Poor	Adequate	Adequate	Adequate	Adequate	Adequate
Overall rating	Poor	Excellent	Adequate	Adequate	Excellent	Excellent
California Mens Colony					b	
Effectiveness	Poor	Marginal	Adequate	Adequate	Excellent	Excellent
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Adequate
Flexibility	Marginal	Marginal	Adequate	Adequate	Excellent	Excellent
Implementation	Poor	Marginal	Marginal	Marginal	Adequate	Adequate
Reclamation potential	Marginal	Poor	Adequate	Adequate	Excellent	Excellent
Compatibility	Poor	Adequate	Adequate	Adequate	Adequate	Adequate
Overall rating	Poor	Marginal	Adequate	Adequate	Excellent	Excellent
Los Osos-Baywood					a	
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	Excellent
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Adequate
Flexibility	Poor	Marginal	Marginal	Marginal	Adequate	Adequate
Implementation	Poor	Marginal	Marginal	Marginal	Marginal	Adequate
Reclamation potential	Poor	Poor	Poor	Poor	Marginal	Excellent
Compatibility	Poor	Poor	Poor	Poor	Poor	Excellent
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	Excellent

[a] Ocean disposal
[b] Stream disposal

indicated that percolation of domestic wastewater in the Los Osos-Baywood area reduces the threat of seawater intrusion. For this reason the percolation disposal option for Los Osos-Baywood is rated higher than the ocean disposal option.

San Luis Obispo Region

The San Luis Obispo Region includes the City of San Luis Obispo and the Avila Sanitary District which serves the community of Avila Beach, Avila Beach State Park and Port San Luis Harbor District Development. The City of San Luis Obispo provides sewerage services to the California State Polytechnic University.

City of San Luis Obispo

The City's treatment plant, just built in 1928, was enlarged in 1942 and upgraded to secondary treatment by means of two-stage biofiltration. The plant was expanded again in 1962-63 to its present reported design capacity of 5.0 mgd. In 1971, the average dry weather flow to the plant was approximately 3.7 mgd and about 29,500 persons resided in its service area.

Wastewaters enter the plant headworks by gravity, pass through a Parshall flume where flow rate is continuously recorded and then through two barminutors. A bar screen set at a 45 degree angle is available should the barminutors become inoperable. Wastewater is discharged into a wet well from which it is pumped by one or more of four influent pumps.

In 1962-63, the plant's original 30-foot diameter, 7.5-foot deep primary clarifier was converted to a grit removal facility. Solids which settle in this tank are pumped to a grit washer, washed, and deposited in a grit hopper. Wastewaters are then introduced to two 80-foot diameter, 10-foot deep primary clarifiers operated in parallel. Effluent from the primary clarifiers enters a recirculation pumping station where three pumps with a total reported capacity of 3,000 gpm circulate the flow through two 100-foot diameter biofilters with a 3-foot rock bed depth. Skimmers remove floating solids from the surface of the clarifiers. Scum and settled sludge are pumped to the first in a series of three anerobic digesters.

The effluent from the primary stage of the plant flows by gravity from the two 80-foot diameter clarifiers to the wet well of the recirculation pumping station that serves the second stage of the plant. The effluent from the primary stage is mixed with recirculated effluent from the second stage and distributed over a 200-foot diameter biofilter with a media depth of 3 feet. The combined flow is discharged to a 130-foot diameter secondary (final) clarifier with a side water depth of 8 feet. Settled sludge is pumped to one of the three anaerobic digesters. A portion of the effluent of the secondary clarifier returns by gravity to the recirculation pumping station and a portion is discharged to a 5-foot deep pond, 220 feet in length and 80 feet in width. Pond effluent flows to a recirculation pumping station which directs the flow to a third stage biofilter. The filter is 100 feet in diameter and contains 3 feet of stone media.

A portion of the effluent of this filter recirculates to the influent end of the pond and a portion flows to a second pond and hence to a chlorine contact tank which is not now in use. Chlorine can be conveyed from two chlorinators in the control building.

Undisinfected plant effluent is used to flood irrigate a 57-acre pasture area surrounding the plant and a smaller area across San Luis Obispo Creek. A portion of the flow is discharged to the irrigated area by gravity and a portion is pumped to the fields north and east of the plant by an effluent pumping station. Runoff from the irrigated areas flows to a 14-acre, 5-foot deep pond and pond effluent is disinfected in a final chlorine contact basin prior to discharge to San Luis Obispo Creek.

The San Luis Obispo collection system allows excessive wet weather infiltration and direct stormwater inflow. An analysis revealed that up to 3,000 gad is contributed to the system by infiltration and direct storm inflow during wet weather. A similar analysis of flows emanating from the Cal Poly campus during wet weather indicates that up to 1,440 gad is contributed by infiltration and direct storm inflow. These stormwater inflow rates are in excess of those consistent with modern sewer design and construction practices. Since a portion of the San Luis Obispo collection system is installed below the groundwater table, it is possible that the system also allows excessive dry weather infiltration.

The plant is expected to have sufficient nominal capacity until the mid-1970's. At that time, it is estimated that the average dry weather flow to the plant will reach 4.0 mgd which is the reported capacity of the existing plant. By the year 2000, it is estimated that the ADWF from the San Luis

Obispo service area will reach about 6.4 mgd. The City has acquired sufficient land area surrounding the existing site to allow for expansions of the plant.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. The plant site is not adequately protected from flooding by San Luis Obispo Creek.

2. During wet weather, a portion or all of the wastewater is bypassed untreated to the lower pond, is chlorinated and is discharged to San Luis Obispo Creek.

3. Several of the process units are not equipped with adequate handrails as required by the National Occupational Health Safety Act.

4. Standby power is sufficient only for the influent pumping station.

The City of San Luis Obispo is required to meet discharge requirements promulgated by the Regional Board in 1967. Except for the discharge of untreated but chlorinated wastewater during periods of wet weather, the City is in compliance with those requirements.

Avila Sanitary District

The Avila treatment facility provides primary treatment and has a design capacity of 0.2 mgd. Constructed in 1968, the plant consists of a covered primary clarifier and an anaerobic sludge digester joined by a control building. The plant was constructed above grade on the south bank of San Luis Obispo Creek. Although the plant is not protected with dikes from flooding by the creek, its above grade construction has rendered it relatively impervious to flood damage.

Raw wastewater initially enters a wet well from which it is pumped to the primary clarifier. Normally one of the two pumps provided for this purpose is sufficient. If necessary, a second pump is available and an emergency alarm sounds if the two pumps are incapable of keeping the wastewater in the wet well at a low enough level. The primary sedimentation tank is 30 feet in diameter and has a side water depth of about 8 feet. Clarified wastewater drawn off by a weir along the tank's perimeter is chlorinated and discharged to the land portion of the ocean outfall. Sludge is pumped from the bottom of the primary clarifier to a 35-foot diameter anaerobic sludge digester with a side wall depth of 21.5 feet. The digester is unmixed and unheated. Digester supernatent is mixed with the raw wastewater in the influent wet well. A small 3-foot deep trickling filter is used for odor control. Sludge gas produced by anaerobic digestion as well as gases drawn from above the clarifier and the influent wet well are forced up through the filter and their odors reduced. Clarifier effluent is sprayed on the trickling filter. Effluent from the filter is mixed with incoming raw wastewater in the wet well. Digested sludge is drawn from the bottom of the digester and dried in a 20- by 30-foot sludge drying bed.

Plant effluent flows by gravity to a 12-inch mortar coated, steel ocean outfall. The outfall terminates as an open-ended pipe at a depth of about 31 feet (M.S.L.) approximately 2,000 feet from shore. The end of the outfall is anchored to a concrete block. A 45-degree elbow in the pipe deflects the effluent downward to increase its dilution with the seawater. The initial dilution is computed to be less than 30 to 1.

Insufficient data are available to assess the adequacy of the Avila Beach collection system. An investigation of dry and wet weather infiltration into the collection system should be conducted.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. The plant is not equipped with grit removal facilities and all grit which is deposited in the primary clarifier is pumped to the digester.

2. Duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality. Only one unit is available for each process.

3. An auxiliary power supply is not available. During power failures, raw wastewater is bypassed to the Pacific Ocean.

Flow estimates indicate that the gravity flow capacity of the ocean outfall will not be reached prior to the year 2000. The initial dilution provided by the ocean outfall does not meet the 100 to 1 dilution required by the State's Ocean Plan.

The Avila ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State's Ocean Plan. Normally primary treatment cannot produce the effluent concentrations of grease and oil, suspended solids and settleable solids required by the State's Ocean Plan. As the Avila Sanitary District did not submit a Technical Report on its ocean discharge, the impact of the discharge on the marine environment is unknown.

Alternative Municipal Wastewater Management Plans — San Luis Obispo Creek Region

Alternative plans involving degrees of consolidation of disposal functions, ocean disposal, land disposal by spray irrigation, and stream disposal have been investigated. Utilizing the assessment of environmental sensitivity, two basic alternative plans, each of which contains several sub-alternatives, and a no action alternative were developed: Alternative I calls for the consolidation of the two existing dischargers with ocean disposal; Alternative II consists of individual treatment and disposal operations.

No Action Alternative. The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overload conditions will develop, reliability and treatment efficiency will decrease and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped or significantly curtailed and the current means of wastewater management with its deficiencies, continued.

Alternative I. Alternative I is basically an ocean discharge alternative and consists of combining existing discharges from the municipal systems of San Luis Obispo and Avila Sanitary District. Under this alternative, effluent will be discharged offshore of Avila Beach through a new outfall with multiport diffuser beginning at 1,000 feet offshore of the 35-foot depth contour. Existing treatment plants at San Luis Obispo and Avila Sanitary District will need upgrading or minor plant improvements to meet the requirements of the new State's Ocean Plan. For disposal, either primary sedimentation with chemical addition or biological secondary treatment with disinfection and dechlorination are considered appropriate. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-9. The estimated project costs of the facilities required for this alternative are given in Table 16-25.

Alternative II. Alternative II involves no consolidation of existing dischargers. The City of San Luis Obispo WTP will be upgraded and enlarged and facilities for ocean disposal, stream disposal, or land disposal with discharge to San Luis Obispo Creek will be provided. The Avila Sanitary District WTP will be upgraded and enlarged with disposal either to the ocean or to a spray irrigation area with storage.

For ocean disposal appropriate treatment levels include primary sedimentation with chemical addition or biological secondary treatment with disinfection and dechlorination. For Avila Sanitary District, the costs of both treatment levels has been estimated. Because the operation and maintenance costs of biological secondary treatment are comparable to those of primary sedimentation with chemical addition and because the capacity of the City of San Luis Obispo's WTP will not be significantly increased during the study period, only the costs of biological secondary treatment have been estimated. Feasibility level studies indicate that ocean disposal in the Avila Beach area should occur through an extended ocean outfall with a multiport diffuser commencing at 1,000 feet offshore of the 35-foot depth contour.

Additional disposal options available to the City include total stream disposal and impoundment in Laguna Lake with overflow to San Luis Obispo Creek. Discharge of effluent to San Luis Obispo Creek or to Laguna Lake will require physical-chemical-biological treatment with nutrient removal, effluent filtration, disinfection and dechlorination. Stream disposal will provide water for downstream use including irrigation; however, benefits of nutrient removal could be lost due to non-point waste sources. See Chapters 5 and 15. Demineralization could be required to match upstream quality; however, salt source control is more cost-effective than dimineralization of wastewater. With the Laguna Lake disposal option, effluent from the plant could be used in the summer to maintain a constant high water level in Laguna Lake, thereby creating a permanent wildlife habitat at the lake which would not be subject to seasonally fluctuating water levels. In the winter, effluent would be discharged directly to San Luis Obispo Creek.

Table 16-25. Evaluation of Economic Factors of Alternatives, San Luis Obispo Creek Region, Thousands of Dollars[a]

Factor/service Area	Alternative I	Alternative II		
	Ocean disposal	Ocean disposal	Stream disposal	Spray irrigation/ stream disposal
Capital cost[b]				
City of San Luis Obispo	10,500	10,600	7,800[e]	8,800
Avila Sanitary District	300[c]	1,200[c]	NA	1,100
Total	10,800	11,800	9,000[d]	9,900
Total annual cost				
City of San Luis Obispo	1,070	1,080	1,240[e]	930
Avila Sanitary District	100[c]	110[c]	NA	120
Total	1,170	1,190	1,350[d]	1,050
Present worth				
City of San Luis Obispo	13,400	13,600	14,000[e]	10,500
Avila Sanitary District	500	1,200	NA	1,700
Total	13,900	14,800	15,200[d]	12,200
Initial local annual financial burden				
City of San Luis Obispo	430	430	630[e]	380
Avila Sanitary District	20	40	NA	40
Total	450	470	670[d]	420

[a] Costs based on an ENR construction cost index of 2000.
[b] Total cost of staged construction of facilities required to meet projected wastewater demands until the year 2000.
[c] Based on primary sedimentation plus chemical addition, disinfection and dechlorination. Capital cost with secondary treatment would be about $100,000 more; total annual cost would be about $15,000 more.
[d] Total costs include ocean disposal for Avila Sanitary District.
[e] Total costs reflect level VI treatment which may not be necessary during Stage 1; see text.
NA = not applicable

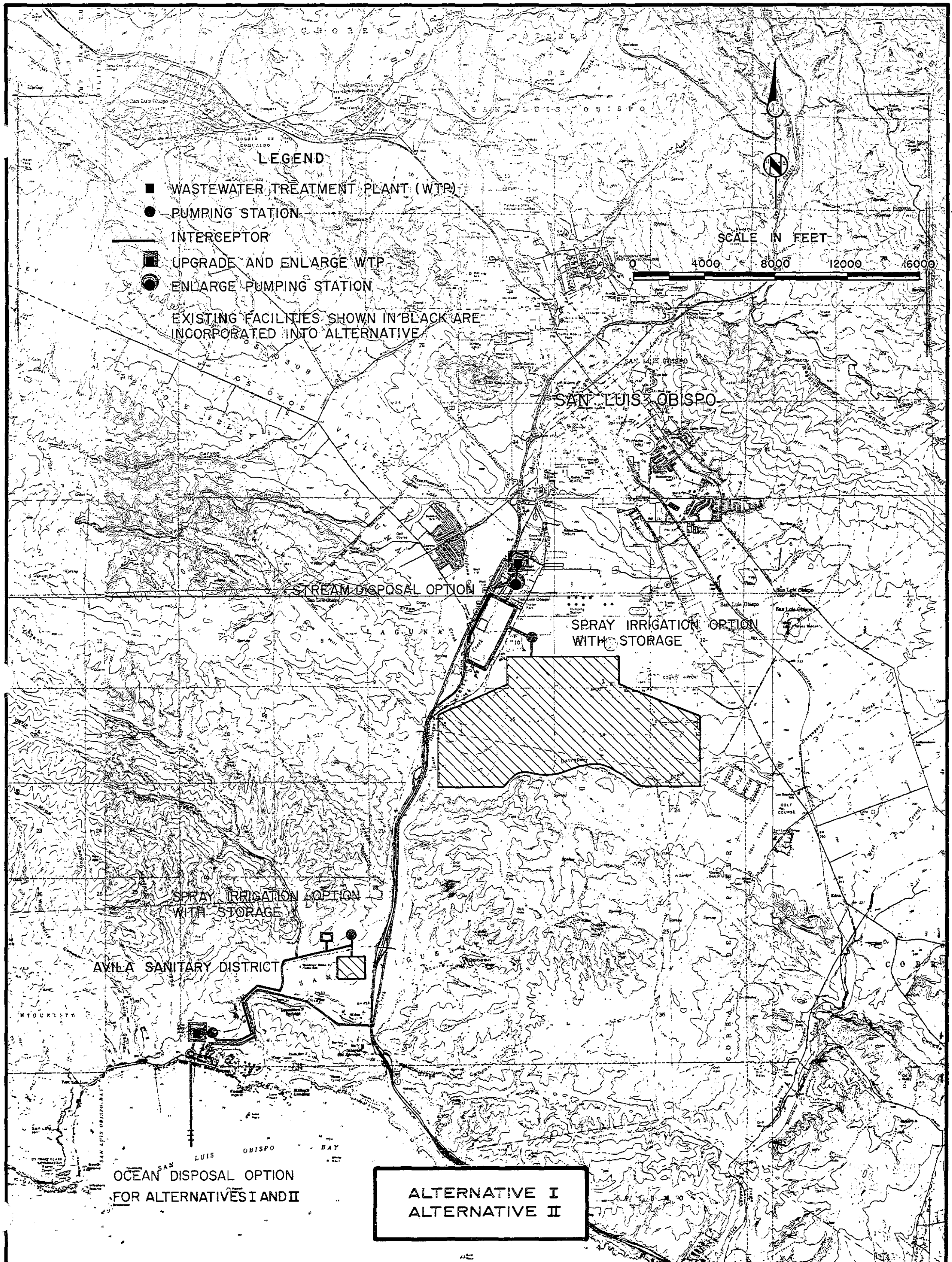


Fig. 16-9 Alternative Municipal Wastewater Management Plans
San Luis Obispo Coastal Subbasin
San Luis Obispo Creek Region

Another disposal option considered technically feasible for both dischargers consists of discharging treated wastewaters to the land through a spray irrigation system in the summer and storing the treated wastewaters in the winter. The stored wastewaters will be disposed of by the spray irrigation system the following summer. Utilizing this concept, no treated wastewater will be discharged to any stream or to the ocean at any time. The City of San Luis Obispo plant will be upgraded and its effluent discharged to a spray irrigation area. Because of poor soils, a unit land requirement of 200 acres per mgd has been assumed. The plant at Avila Beach will be upgraded and effluent from the plant will be sprayed in an area upstream of the plant site. Wet weather storage will be provided.

Yet another disposal option considered technically feasible for both dischargers envisions separate treatment plants with disposal to the land in the summer. During the winter, the City of San Luis Obispo would discharge to the Pacific Ocean. Because the total annual costs of this disposal option far exceeded the costs of stream disposal for the City and either ocean disposal or spray irrigation with storage for the Avila Sanitary District, this option was given no further consideration for either discharger.

The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-9. The impoundment option and spray irrition with stream discharge option for the City of San Luis Obispo and the spray irrigation with ocean discharge option for Avila Sanitary District were dropped from detailed consideration because of excessive cost. The estimated project costs of the facilities required for this alternative are given in Table 16-25.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to export wastewaters to a neighboring sub-basin, plans for percolation disposal systems in inland areas, etc.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be apparent and should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water in the San Luis Obispo Creek Region include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge.

Agriculture. Irrigated agriculture is a significant land use in the San Luis Obispo Creek Region. Wastewaters from the City of San Luis Obispo WTP are now used to flood irrigate pasture land adjacent to the WTP. Such reuse of wastewater should be encouraged.

Industry. There are apparently no significant industrial demands for reclaimed wastewater in the region and it is not expected that such potential will exist in the future.

Recreation and Land Beautification. A City park is planned on the northeast side of Laguna Lake which could exert a significant demand for reclaimed water. Reuse of reclaimed water to irrigate a golf course adjacent to the Avila Sanitary District plant site should be investigated at the project planning level.

Domestic Use. It is highly unlikely that direct domestic reuse, which is presently prohibited by the State Department of Health, will be implemented until all sources of new water supply have been exhausted. In the event that planned programs to import water are not implemented or fail to meet the ultimate needs of the area, the first step would be to substitute reclaimed water for the potable supplies now used for agriculture, recreation and land beautification purposes. Only then is consideration likely to be given to the reclamation of wastewater for domestic use. On the basis of present conditions, therefore, it must be concluded that this form of water reuse may not need to be considered in detail for many years.

Streamflow Augmentation. Treated wastewater from the City of San Luis Obispo WTP could be used to augment the flow of San Luis Obispo Creek or to maintain a constant level in Laguna Lake.

Groundwater Recharge. Because of inappropriate soils and geology, groundwater recharge with reclaimed water does not exhibit significant potential.

Summary. The previous discussion has indicated that the outlook may be favorable for the reuse of reclaimed water for agriculture, recreation and land beautification and streamflow augmentation in the study area. Plans which encourage such reuses should be favored.

Comparison of Alternatives — San Luis Obispo Creek Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-25.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

Costs for ocean disposal with or without Avila Beach consolidation with the City of San Luis Obispo are comparable for the region; costs for stream or land disposal options described under Alternative II are lower in terms of capital expense. Operation costs are higher for stream disposal where level VI treatment is provided; however if level VI treatment is deferred due to negation of benefits to water quality by non-point wastes, then the stream disposal option is the least cost alternative in terms of all economic factors. A staged program involving upgrading to nutrient removal as warranted by non-point controls is more economically attractive than a major committment to land disposal on poor soils. It is expected that level II treatment could be maintained for stream disposal through much if not all of Stage I. Under this arrangement the present worth of all alternatives are more nearly comparable.

Comparison of the cost of ocean disposal to the cost of spray irrigation with storage for Avila Sanitary District indicates that the total capital cost of the facilities necessary for ocean disposal is about 20 percent greater than the cost of the facilities required for land disposal, but the total annual cost is about 10 percent less. If the District is required to provide secondary treatment prior to ocean disposal, the economics of land disposal become more favorable. Project level studies of soils and other constraints to the location of land disposal sites and of oceanographic conditions and the sensitivity of the environment in the vicinity of the outfall will be necessary to firmly establish the economics of this situation.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-26. For the City of San Luis Obispo, Alternative II with stream disposal is rated higher than the other alternatives and disposal options. The long land outfall called for by ocean disposal options for the City would limit flexibility to changes in the rate of population growth. The ocean disposal and spray irrigation with storage options for Avila Beach are rated equally.

South County Region

The South County Region includes municipal wastewater treatment facilities operated by the City of Pismo Beach, the South San Luis Obispo County Sanitation District and the Lopez Recreational Area.

City of Pismo Beach

Wastewater flows from the Sunset Palisades, Shell Beach, Pismo Beach proper and the Five-Cities areas are all collected at the Addie Street Pumping Station, comminuted and pumped via a 12-inch cast iron force main to the City of Pismo Beach wastewater treatment plant, located 3,200 feet inland from the ocean. The pumping station's capacity was increased to a reported 1.59 mgd in 1972. It has been provided with an emergency power generator to insure continued operation in the event of a power failure. The ultimate capacity of the force main to the treatment plant is reported to be 3.48 mgd.

Table 16-26. Evaluation of Functional Factors of Alternatives, San Luis Obispo Creek Region

		Alternative I	Alternative II		
Service area/factor	No action	Ocean disposal	Ocean disposal	Stream disposal	Spray irrigation with storage
City of San Luis Obispo					
Effectiveness	Poor	Marginal	Marginal	Excellent	Marginal
Reliability	Poor	Adequate	Adequate	Excellent	Adequate
Flexibility	Marginal	Poor	Poor	Excellent	Adequate
Implementation	Poor	Poor	Poor	Adequate	Poor
Reclamation potential	Marginal	Adequate	Adequate	Excellent	Excellent
Compatibility	Poor	Marginal	Adequate	Excellent	Poor
Overall rating	Poor	Marginal	Marginal	Excellent	Marginal
Avila Sanitary District					
Effectiveness	Poor	Excellent	Excellent	NA[a]	Excellent
Reliability	Poor	Adequate	Excellent	NA	Adequate
Flexibility	Marginal	Adequate	Adequate	NA	Adequate
Implementation	Poor	Adequate	Adequate	NA	Adequate
Reclamation potential	Marginal	Adequate	Adequate	NA	Excellent
Compatibility	Poor	Marginal	Excellent	NA	Excellent
Overall rating	Poor	Adequate	Excellent	NA	Excellent

[a]NA = not applicable

The City of Pismo Beach treatment plant is designed to provide secondary treatment by means of a step aeration activated sludge process and has an ADWF capacity of 1.0 mgd. Wastewaters influent to the plant enter an aerated grit chamber where inorganic solids which would otherwise accumulate in the digester are removed. Primary sedimentation occurs in two 30-foot diameter tanks. Carbonaceous oxidation takes place in two aeration tanks, each 60 feet in length, 20 feet in width and 15 feet in depth. Wastewaters are disinfected in a chlorine contact chamber. At average design flow, the tank will provide a contact time of 39 minutes. Facilities are available to deliver up to 200 pounds of chlorine per day.

Settled activated sludge is returned to the aeration basins by two sludge pumps. Waste activated sludge is returned to the primary clarifiers for thickening. Settled primary and waste activated sludge is pumped to a single, 25,100 cubic foot anaerobic digester. The digester is heated by pumping the sludge through an external heat exchanger which can use both digester gas and natural gas as a fuel. Waste digester gas is burned in a waste gas burner. Digester supernatant is returned to the headworks of the plant. Digested sludge is dried on a total of 22,000 square feet of sludge drying beds. Ultimate disposal of the dried, digested sludge is as soil conditioner, and plans call for its conveyance to a local fertilizer company for incorporation into their product.

The City's outfall was replaced by the Army Corps of Engineers after the 1969 floods. It was constructed of asphalt lined and coated corrugated metal pipe with an inside diameter of 18 inches. The outfall extends about 940 feet offshore to a water depth of 21 feet (MSL). The outfall has a calculated design gravity flow capacity of 3.5 mgd and terminates in a wye structure constructed of two open-ended 20-foot sections of 18-inch pipe. The outfall is secured by pilings at 50-foot intervals along its length. The outfall is not equipped with a cathodic protection system. A computer simulation of the performance of the outfall indicates that at a flow of 0.53 mgd, the effluent is initially diluted by less than 10 to 1 with seawater during the summer. Because of a lack of data, it is not possible to analyze the variation in wet weather flows to the treatment plant. The age of portions of the sewerage system (greater than 25 years) has prompted the City to initiate a program of inspection and correction.

The estimation of future flows to the system indicates that the treatment plant will have sufficient capacity beyond the year 2000. The plant's flexibility and reliability is limited since a duplicate anaerobic digester is not available.

Flow estimates indicate that the gravity flow capacity of the ocean outfall will be reached in the late 1980's. By the year 2000, its capacity will have to be increased to in excess of 4.1 mgd. The City of Pismo Beach ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State Ocean Plan. Computer simulation of the performance of the outfall indicates that the discharge will not meet the 100 to 1 initial dilution requirement of the plan. The plant will also require much closer effluent quality surveillance to meet the stringent effluent requirements of the plan.

South San Luis Obispo County Sanitation District

The South San Luis Obispo County Sanitation District system provides service to the communities of Grover City, Arroyo Grande and Oceano. The wastewater collection system consists of about 6.1 miles of trunk sewers owned by the District and three sewerage subsystems owned and maintained by the City of Arroyo Grande, Grover City and the Oceano Sanitary District. The trunk sewers were constructed in 1965-66 and consist predominantly of 18 to 30-inch epoxy lined asbestos concrete pipe. The system also includes a 12, 15 and 18-inch three barrel siphon constructed of steel pipe encased in concrete which conveys wastewater beneath Arroyo Grande Creek.

The South San Luis Obispo County Sanitation District WTP provides secondary treatment by means of the conventional activated sludge process. The reported ADWF design capacity of the plant is 2.5 mgd. Untreated wastewater enters the plant through a Parshall flume where flow rate is continuously measured and recorded. Downstream of the flume, wastewaters flow through one of two comminuting devices. Two bypass bar screens are available, if needed.

Two pumps lift the wastewater from an influent pumping station wet well and discharge it to a 55-foot diameter primary sedimentation tank. Primary effluent presently enters one of four available aeration tanks, 15 feet in width and 14 feet deep which form a concentric band around the secondary clarifier. Activated sludge is departed from the treated wastewater in a 65-foot diameter final clarifier.

Primary and waste activated sludges are pumped to a heated anaerobic digester which consists of concentric primary and secondary digesters in the same structure. The primary portion of the digester consists of a 50-foot diameter tank centered in a 70-foot diameter tank. The outer 10 feet of the larger tank is the secondary digester. The side water depth of both tanks is 24 feet. The plant is provided with a 24 by 60-inch solid bowl centrifuge which is occasionally used. Digested sludge is dried on 3 drying beds with a total area of 26,000 square feet. Dried sludge is stock-piled at the plant site for use as a soil conditioner and fertilizer.

Plant effluent is chlorinated with two chlorinators and discharged to the land portion of the District's ocean outfall. The outfall serves as the plant's chlorine contact chamber. The outfall pipe is 36-inches in diameter and constructed of Armco "Smooth Flo" pipe, which is made of corrugated steel coated inside and outside with asphalt and asbestos fiber. The ocean outfall terminates as an open-ended pipe about 1930 feet from a manhole on the beach which is used as the effluent sampling point. Under summer conditions the shoreline is about 880 seaward of the immediate beach and thus the end of the outfall is 950 feet from shore. Because of shifting sand the depth varies, but recent soundings have indicated that the end of the outfall is buried beneath about two feet of sand at a depth of about 35 feet (MSL). The outfall is reported to be damaged. The calculated gravity flow capacity of the outfall when unobstructed is 25 mgd. It is not equipped with a cathodic protection system. The outfall has developed leaks at several points which has caused portions of the adjacent beach to be quarantined.

The capacities of the major trunk sewers and interceptors of the South San Luis Obispo System were appraised in 1963 prior to the consolidation of the three subsystems. The major sewers in the area are reported to be of sufficient capacity to accommodate waste flows from the service area at the time of "ultimate development."

An analysis of wet weather flows in the system indicates that up to 880 gad of stormwater inflow occurs. This amount of stormwater inflow is consistent with modern sewer design and construction practices.

The estimation of future wastewater flows from the system presented in Chapter 5 indicates that the treatment plant will have sufficient nominal capacity beyond the year 2000. The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to its introduction to the primary clarifier and thus the digester.

2. Insufficient duplicate process units are available to enable the bypass and repair and/or maintenance of major units. Only one primary and one secondary sedimentation tank are available.

3. An auxiliary power supply is not available.

4. The ocean outfall is damaged and should be replaced.

The South San Luis Obispo County Sanitation District WTP will have to meet the receiving water and effluent quality requirements stipulated in the State's Ocean Plan. Computer simulation of the performance of the outfall indicates that the discharge will not meet the 100 to 1 initial dilution required by the plan. The plant will require much closer effluent quality monitoring to meet the stringent effluent quality requirements of the plan.

Lopez Recreational Area

The Lopez Recreational Area is located on the east shore of Lopez Reservoir, a multipurpose dam and reservoir project owned and operated by the San Luis Obispo County Flood Control and Water Conservation District. The reservoir is situated about 6 miles northeast of the City of Arroyo Grande.

The Lopez Recreational Area WTP is designed to provide secondary treatment by either the extended aeration or the conventional activated sludge process and has a design capacity of 0.10 mgd. Wastewater entering the plant passes through a Parshall flume and then through a comminuting device. Comminuted wastewaters are then directed to three aeration basins; the mixture of activated sludge and oxidized wastewater flows to two secondary clarifiers. When operating in the extended aeration mode almost all of the settled sludge is returned to the aeration basins. At high flows and loads, waste activated sludge flows to an aerobic sludge digester where it is stabilized prior to being hauled by truck to sludge drying beds located near the disposal ponds.

Treated wastewater falls into a wet well and is pumped by two effluent pumps through a 10,000 foot 6-inch diameter force main to three oxidation percolation ponds located upstream of the reservoir. A 33,000 gallon holding basin is provided at the treatment plant site to which treated effluent can overflow in the event of a mechanical or power failure of the effluent pumps.

The existing facilities have sufficient nominal capacity to handle current wastewater flows and loads. Flows during the tourist season approach the design capacity of the plant, however, and more capacity should be provided in the near future.

The treatment plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the aeration tanks.

2. An auxiliary power supply is not available.

3. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality during the peak tourist season.

The Lopez Recreational Area WTP is required to meet discharge requirements promulgated by the Regional Board in 1967. Adequate provision has not been made to prevent overflow or bypass of treated or untreated effluent to the reservoir from pumping stations or from the collection system as a result of power or mechanical failure. Sufficient duplicate units and an alternative power supply for the pumping stations should be provided, or a contingency plan for closure of the recreation area should be developed.

Alternative Municipal Wastewater Management Plans — South County Region

Alternative plans involving degrees of consolidation of treatment and disposal functions, ocean disposal, land disposal by spray irrigation and percolation and stream disposal have been investigated. Utilizing the assessment of environmental sensitivity, three basic alternative plans, each of which contains several sub-alternatives, and a no action alternative were developed: Alternative I calls for the consolidation of the existing dischargers from Pismo Beach north at the upgraded and enlarged City of Pismo Beach WTP; Alternative II involves the conveyance of treated wastewater from the City of Pismo Beach to a new ocean outfall in the vicinity of the South San Luis Obispo County Sanitation District; Alternative III consists of enlarging and upgrading the existing treatment and disposal facilities.

No Action Alternative. The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped, or significantly curtailed, and the current means of wastewater management with its deficiencies, continued.

Alternative I. Alternative I consists of the consolidation of the existing dischargers north of Pismo Beach at the enlarged and upgraded City of Pismo Beach WTP. The existing treatment and disposal system at Avila Beach will be abandoned and the District's untreated wastewaters will be conveyed to the City of Pismo Beach WTP. Disposal will be either to the ocean through a new ocean outfall with a multiport diffuser or to percolation basins located in Price Canyon. With this alternative plan, the South San Luis Obispo County Sanitation District WTP will be enlarged and upgraded and disposal will be by means of either a new ocean outfall with a multiport diffuser or by stream disposal.

For planning purposes it is assumed that for the ocean disposal option, after biological secondary treatment, wastewaters will be discharged to the ocean through multiport diffusers commencing at 1,000 feet beyond the 35-foot depth contour. Because both the City of Pismo Beach ocean outfall and the South San Luis Obispo County Sanitation District ocean outfall are constructed of corrugated steel and are not cathodically protected, it is assumed that new outfalls will be constructed rather than extending the present outfalls.

Because discharge to Arroyo Grande Creek by the South San Luis Obispo County Sanitation District and discharge to percolation basins by the City of Pismo Beach Creek will result in recharge of the groundwater basin which already contains excessive nitrates, it is assumed that biological nitrification and denitrification (nitrogen removal) will be necessary. In addition, for stream disposal, effluent filtration, disinfection to an MPN of 2.2 coliform organisms per 100 ml, and dechlorination will be necessary. Because stream disposal of the entire wastewater flow would be almost double the total annual costs of ocean disposal for the District, stream disposal of the entire wastewater flow was given no further consideration. With this Alternative, the Lopez Recreation Area WTP will be enlarged and upgraded; disposal options include percolation and spray irrigation with storage. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-10. The estimated project costs of the facilities required for the economically feasible disposal options of this alternative are given in Table 16-27.

Alternative II. Alternative II calls for upgrading and enlarging the existing wastewater treatment plants. Appropriate disposal options for Avila Sanitary District include ocean discharge and spray irrigation with storage. With this alternative, treated wastewaters from the City of Pismo Beach WTP and from the South San Luis Obispo County Sanitation District WTP will be discharged through a joint new ocean outfall. Disposal options available to Lopez Recreation area include percolation and spray irrigation with storage. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-10. The estimated project costs of the facilities required for this alternative are given in Table 16-27.

Alternative III. Alternative III consists of enlarging and upgrading the existing municipal wastewater systems with either land or ocean disposal. The Avila Sanitary District, City of Pismo Beach, South San Luis Obispo County Sanitation District and Lopez Recreation Area WTP's will be enlarged and upgraded. Appropriate disposal options for Avila Sanitary District include ocean disposal and spray irrigation with storage. For the City of Pismo Beach appropriate disposal options include ocean disposal and percolation. For the South San Luis Obispo County Sanitation District ocean disposal was considered. Disposal options for Lopez Recreation Area include percolation and spray irrigation with storage. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-10. The estimated project costs of the facilities required for this alternative are given in Table 16-27.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge. Potential reuses which are particularly promising and which should be investigated at the project planning level include agriculture, golf course irrigation, stream flow augmentation and groundwater recharge. Because the Arroyo Grande Valley groundwater basin contains excessive nitrates and the beneficial use of that water for domestic purposes has been threatened, project level studies may indicate that a program of groundwater recharge using reclaimed wastewater to flush out or dilute the degraded groundwater may be cost-effective. Such a program should be the subject of project level studies.

Comparison of Alternatives — South County Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the plan is selected.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this in only one of several methods of allocating

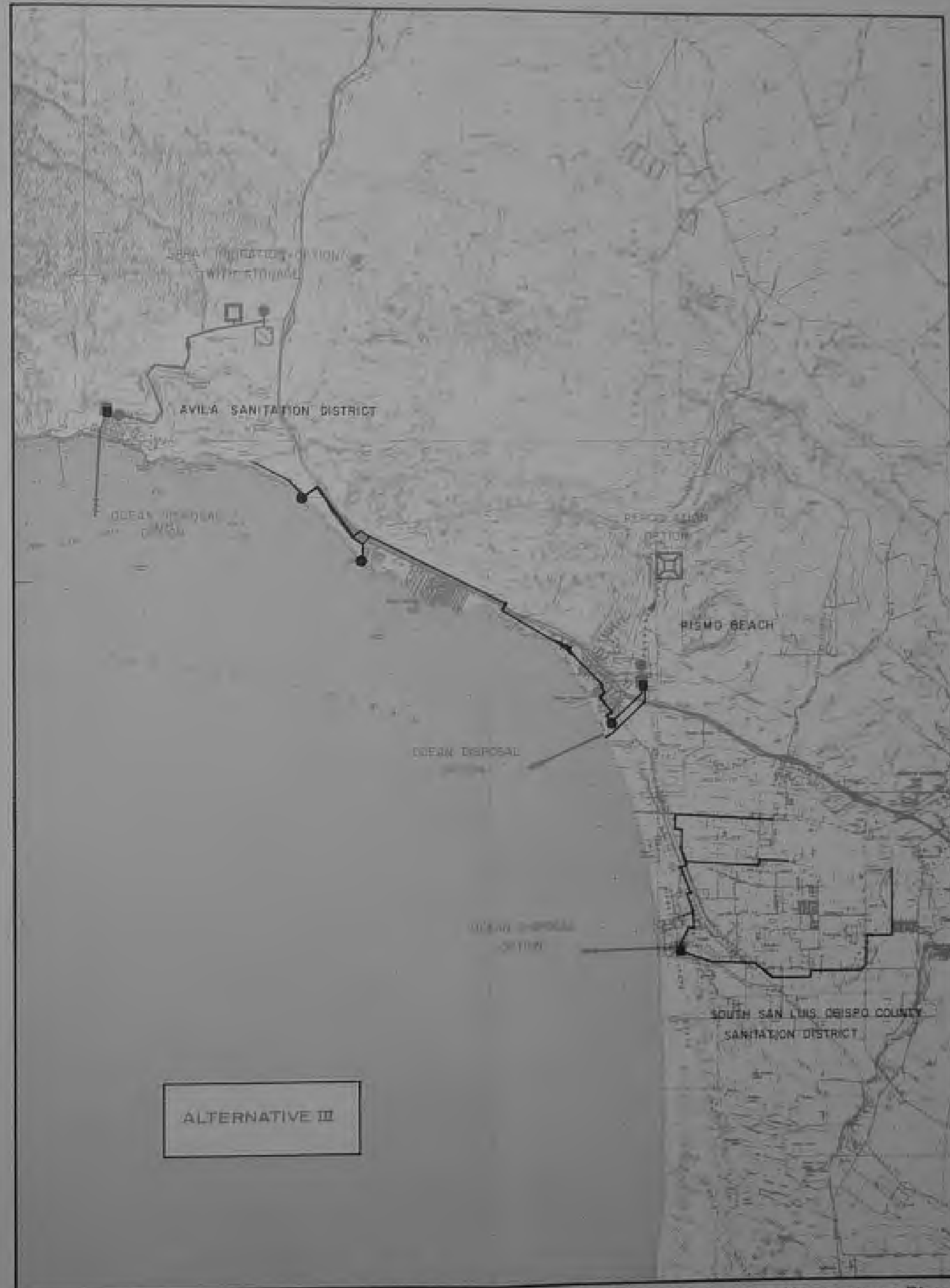


Fig. 16-10 Alternative Municipal Wastewater Management Plans
San Luis Obispo Coastal Subbasin
South County Region

Table 16-27. Evaluation of Economic Factors of Alternatives, South County Region, Thousands of Dollars[a]

Factor/service area	Alternative I: Ocean disposal	Alternative I: Percolation	Alternative II: Ocean disposal	Alternative III: Ocean disposal	Alternative III: Percolation	Alternative III: Spray irrigation with storage
Capital cost[b]						
Avila Sanitary District	2,000	1,900	1,200[c]	1,200[c]	NA[d]	1,300
City of Pismo Beach	3,000	2,000	2,600	2,600	1,800	NA
South San Luis Obispo County Sanitation District	3,300	NA	3,400	3,300	NA	NA
Lopez Recreation Area	NA	NA	NA	NA	200	400
Total	8,500[e]	NA	7,400[e]	7,600[e]	NA	NA
Total annual cost						
Avila Sanitary District	170	170	110[c]	110[c]	NA	120
City of Pismo Beach	320	310	310	310	290	NA
South San Luis Obispo County Sanitation District	440	NA	450	440	NA	NA
Lopez Recreation Area	NA	NA	NA	NA	50	70
Total	1,980[e]	NA	920[e]	920[e]	NA	NA
Present worth						
Avila Sanitary District	2,200	2,100	1,200	1,200[c]	NA	1,700
City of Pismo Beach	3,900	3,400	3,700	3,700	3,300	NA
South San Luis Obispo County Sanitation District	5,100	NA	5,100	5,100	NA	NA
Lopez Recreation Area	NA	NA	NA	NA	600	800
Total	11,800	NA	10,600[e]	10,800[e]	NA	NA
Initial local annual financial burden						
Avila Sanitary District	40	40	40[c]	40[c]	NA	40
City of Pismo Beach	140	140	140	140	150	NA
South San Luis Obispo County Sanitation District	210	NA	210	210	NA	NA
Lopez Recreation Area	NA	NA	NA	NA	30	40
Total	420[e]	NA	420[e]	420[e]	NA	NA

[a] Costs based on an ENR construction cost index of 2000.
[b] Total cost of staged construction of facilities required to meet projected wastewater demands until the year 2000.
[c] Based on primary sedimentation plus chemical addition, disinfection and dechlorination. Capital cost with secondary treatment would be about $100,000 more; total annual cost would be about $20,000 more.
[d] NA = not applicable.
[e] Total includes percolation disposal option for Lopez Recreation Area.

costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

The alternative having the least total capital and total annual costs is Alternative II. Based on cost alone, therefore, some form of local or sub-regional treatment is preferable to alternatives which involve the conveyance of untreated wastewater. Feasibility level estimates indicate that a form of land disposal is the most economical disposal option for Lopez Recreation Area.

Feasibility level cost estimates also indicate that it will be slightly less expensive for the City of Pismo Beach and for the South San Luis Obispo County Sanitation District to continue with ocean disposal through a new joint ocean outfall. This conclusion is based on the assumption that both the existing ocean outfall serving Pismo Beach and the existing ocean outfall serving the South San Luis Obispo County Sanitation District will require complete replacement during the 30-year time frame of this study. If project level studies indicate that it is possible to extend either of the existing outfalls and construct multiport diffusers, then ocean disposal through separate outfalls may be more economical.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-28.

Based on analysis of functional factors, Alternatives II and III are preferable to the other Alternatives. For Avila Sanitary District both disposal options received an equal overall rating. For the City of Pismo Beach and for the South San Luis Obispo County Sanitation District, ocean disposal through a new joint ocean outfall is rated slightly lower than ocean disposal through separate new ocean outfalls. The slightly lower rating is due to the possible difficulties in the implementation of a joint facility.

SODA LAKE SUB-BASIN

The Soda Lake Sub-basin is a large enclosed basin located in the southeastern portion of San Luis Obispo County. There are presently no municipal sewerage systems in the sub-basin. Waste loads are imposed on the receiving waters of the sub-basin by about 760 acres of irrigated agriculture, by low density stock grazing, by individual waste disposal systems, and by nonurban runoff. Most of the individual waste disposal systems occur in the community of Simler.

Because the population and economic forecasts presented in Chapter 12 suggest that no significant increases in development will occur during the study period, no specific municipal or industrial wastewater management plans have been formulated. The management plan for unsewered areas such as Simler is described under individual disposal systems, see Chapter 5.

SANTA MARIA RIVER SUB-BASIN

Municipal waste discharges in the Santa Maria River Sub-basin include County Service Area 1 in the Nipomo area, the City of Guadalupe, the City of Santa Maria, the Laguna County Sanitation District, the Santa Maria Airport and the community of New Cuyama.

County Service Area 1

County Service Area 1 was recently formed to assume the ownership, operation and maintenance of the sewerage systems serving the Nipomo Palms Mobile Home Subdivision and the Galaxy Park Mobile Home Subdivision. The Nipomo Palms Mobile Home Subdivision is served by a septic tank and subsurface leaching system to treat and dispose of 16,000 gallons per day. The Galaxy Park Mobile Home Subdivision wastewaters are treated by means of subsurface leaching from a septic tank system designed to handle 23,000 gallons per day. Both dischargers are required to comply with waste discharge requirements adopted by the Regional Board in 1971. The dischargers are in compliance with those requirements.

City of Guadalupe

The basic wastewater collection system for the City of Guadalupe was constructed in 1924-25. The system consists almost entirely of 6-inch iron pipe. The interceptor to the plant is 8 to 12-inch iron pipe; two small lift stations assist in conveying the flow to the plant. In the past, it is reported that the lift stations have had no problem in pumping peak wet weather flows. The small (6-inch) size of most of the pipes in the system and the lack of restaurant grease traps have resulted in a continuous problem with sewer

Table 16-28. Evaluation of Functional Factors of Alternatives, South County Region

Service area/Factor	No action	Alternative I: Ocean disposal	Alternative I: Percolation	Alternative II: Ocean disposal	Alternative III: Ocean disposal	Alternative III: Percolation	Alternative III: Spray irrigation with storage
Avila Sanitary District							
Effectiveness	Poor	Marginal	Marginal	Excellent	Excellent	NA	Excellent
Reliability	Poor	Adequate	Adequate	Excellent	Excellent	NA	Adequate
Flexibility	Marginal	Poor	Poor	Adequate	Adequate	NA	Adequate
Implementation	Poor	Poor	Poor	Adequate	Adequate	NA	Adequate
Reclamation potential	Poor	Poor	Poor	Adequate	Adequate	NA	Excellent
Compatibility	Poor	Marginal	Marginal	Excellent	Excellent	NA	Excellent
Overall rating	Poor	Marginal	Marginal	Excellent	Excellent	NA	Excellent
City of Pismo Beach							
Effectiveness	Poor	Excellent	Excellent	Excellent	Excellent	Adequate	NA
Reliability	Poor	Excellent	Adequate	Excellent	Excellent	Adequate	NA
Flexibility	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	NA
Implementation	Poor	Adequate	Adequate	Adequate	Excellent	Adequate	NA
Reclamation potential	Marginal	Adequate	Excellent	Adequate	Adequate	Excellent	NA
Compatibility	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	NA
Overall rating	Poor	Adequate	Adequate	Adequate	Excellent	Adequate	NA
Souuth San Luis Obispo County Sanitation District							
Effectiveness	Poor	Excellent	NA	Excellent	Excellent	NA	NA
Reliability	Poor	Excellent	NA	Excellent	Excellent	NA	NA
Flexibility	Marginal	Adequate	NA	Adequate	Adequate	NA	NA
Implementation	Poor	Excellent	NA	Adequate	Excellent	NA	NA
Reclamation potential	Marginal	Adequate	NA	Adequate	Adequate	NA	NA
Compatibility	Poor	Adequate	NA	Adequate	Adequate	NA	NA
Overall rating	Poor	Excellent	NA	Adequate	Excellent	NA	NA
Lopez Recreation Area							
Effectiveness	Poor	NA	Excellent	NA	NA	Excellent	Excellent
Reliability	Poor	NA	Adequate	NA	NA	Adequate	Adequate
Flexibility	Marginal	NA	Adequate	NA	NA	Excellent	Excellent
Implementation	Poor	NA	Excellent	NA	NA	Adequate	Adequate
Reclamation potential	Marginal	NA	Excellent	NA	NA	Excellent	Excellent
Compatibility	Poor	NA	Adequate	NA	NA	Adequate	Adequate
Overall rating	Poor	NA	Excellent	NA	NA	Excellent	Excellent

blockage. Much of the single plant operator's time is spent clearing these blockages. Most of the community is served by a separate stormwater drainage system.

The Guadalupe WTP was originally a primary treatment plant, built in 1924-25. In 1970-71, the plant was modified by the addition of an aeration basin, a secondary clarifier and a digester heating facility. The reported design capacity of the plant is 0.5 mgd. Wastewater entering the plant passes through a comminuting device or a bar screen and falls into a wet well situated beneath the control building. Raw wastewater is lifted by influent pumps and discharged to a single 40-foot diameter clarifier. Primary settled sludge and scum are pumped to the facilities single anaerobic digester. Clarified primary effluent is pumped into a circular aeration basin and aerated with floating aerators. One third of the effluent of the aeration tank flows to the primary and two-thirds flows to the secondary clarifier. Secondary effluent is recirculated to the aeration tank.

Waste activated sludge, primary sludge and scum are pumped to a single, heated anaerobic digester. Digested sludge is discharged to sludge drying beds. Ultimate disposal of the solids is as fertilizer and soil conditioner.

Treated but undisinfected effluent is discharged to a 12-inch gravity land outfall which conveys it to 90 acres of permanent pasture west of the plant for use as irrigation water. During wet weather period, the effluent is used to flood irrigate a much larger area downstream of the 90-acre parcel. It is also possible to store plant effluent in two small ponds at the plant site.

A large proportion of restaurant wastewater and a predominance of 6-inch sewers in the City's collection system have combined to create serious grease clogging problems. The installation and proper maintenance of adequately designed grease traps and the use of 8-inch sewers as the minimum size would help to alleviate the problem.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. The existing comminuting device is in need of repair or replacement.

2. The plant is not equipped with grit removal facilities and consequently, all grit which is deposited in the primary sedimentation tank is pumped to the digesters.

3. Each of the plant's processes is served by a single unit making it impossible to take a unit out of service for maintenance without shutting down the process and adversely affecting effluent quality.

4. The plant's single digester is equipped with inadequate sludge circulation and mixing equipment.

5. The plant's mechanical equipment is in a general state of disrepair.

6. The plant has no disinfection facilities.

7. The plant has only one operator and is thus unattended a significant portion of the time.

The City of Guadalupe WTP is required to meet discharge requirements promulgated by the Regional Board in 1969. During wet weather, the requirements are violated in that undisinfected wastewater can run off the land disposal area.

City of Santa Maria

The City of Santa Maria presently provides wastewater collection, treatment and disposal to a population of about 33,000 and to a variety of industries. Food processing industries, in particular, contribute a significant amount of wastewater to the City's sewerage system. Approximately 2,800 acres within the City have been zoned for industrial use and it is anticipated the amount of industrial wastewater influent to the system will increase in the future. In 1972, the average dry weather flow to the plant was about 4.9 mgd during the food processing season.

A major contributor of industrial wastes to the system is the Western Refrigeration Company, which is a food processing plant. The plant has its own wells which are metered and the amount of wastewater contributed by the plant is determined by its water use. The plant has contributed up to 1.6 mgd to the City's sewers during the peak processing season. The plant operates 24 hours per day and causes very little peaking in the flow rate to the wastewater treatment plant.

Major components of the Santa Maria sewerage system are two interceptor sewers. A south interceptor consists of 15-inch to 30-inch pipe and collects wastewater from Battles Road south to near the Santa Maria Public Airport and conveys it to the City's wastewater treatment plant. A second interceptor, the Main Street interceptor, serves the area from Battles Road north and conveys wastewater to the same plant. It consists of a 30-inch and parallel 14-inch to 27-inch pipes which slope in a westerly direction on Main Street. The area north of Donovan Street is served by a lift station which delivers the wastewater to the Main Street interceptor through a 14-inch force main (which will be replaced with a larger pipe in the near future) and a 15-inch gravity sewer. Stormwaters are drained from the service area by a separate sewerage system.

The City of Santa Maria WTP provides secondary treatment by means of two stage biofiltration and has an ADWF design capacity of 6.5 mgd. Wastewaters enter the plant by gravity and flow through a mechanically cleaned bar screen. Screenings are incinerated by an incinerator used solely for that purpose. A portion of the flow (about 25 percent) is diverted through the original plant units which consist of an aerator, a vacuator, primary and secondary clarifiers and a biofilter. Effluent from the older portion of the plant is re-combined with the remaining plant influent and applied to the newer units.

The combined flow enters a 140-foot diameter primary clarifier. Primary effluent and recirculated primary biofilter effluent is pumped to the primary biofilter which is 180 feet in diameter with a rock media depth of 3 feet. All of the effluent from the primary biofilter returns to the primary sedimentation tank. Wastewaters are then pumped to a secondary biofilter identical to the primary filter. Effluent from the secondary filter flows to a secondary sedimentation tank which is identical to the primary sedimentation tank. It is possible to recirculate effluent from the secondary sedimentation tank to the secondary biofilter.

Sludge from the vacuator and the clarifiers is pumped to a "Dorrclone" for degritting prior to thickening. Concentrated solids are subsequently fed to three anaerobic digesters. The digesters are heated and mechanically mixed. Digested sludge is dried on six earth-diked beds. Because of the sandy nature of the soil underlying the beds, no underdrains were provided. Ultimate disposal of the dried sludge is by conveyance to a landfill.

Treated wastewater is discharged to several adjacent percolation ponds with a total area of 40.25 acres. Farmers in the area use the ponded effluent to flood irrigate up to 210 acres of pasture and crop land during dry weather.

A field inspection of the existing plant was made during the conduct of the study and the following deficiencies were noted:

1. Portions of the plant are in a general state of disrepair.

2. An auxiliary power supply is not available.

3. Insufficient standby mechanical equipment, such as sludge pumps, limit the plant's flexibility during periods of mechanical failure.

4. The digester mixing equipment is not functioning and accumulation of grit in the digester has occurred. Plant personnel are now in the process of cleaning the digesters.

5. The laboratory and operations facilities are inadequate for a plant of the size of the Santa Maria WTP.

The City of Santa Maria is required to meet discharge requirements promulgated by the Regional Board in 1972. Concentrations of TDS, sodium and chloride in the wastewater discharged to the land disposal area exceed the median concentration limits set by the Regional Board.

Laguna County Sanitation District

The Laguna County Sanitation District is located south of the City of Santa Maria and provides sewerage service to an area of about 12,000 acres and a population of about 16,400. The District's wastewater collection system was constructed in 1960. The north trunk sewer consists of 12 to 27-inch pipe and the south trunk sewer consists of 10 to 21-inch pipe. Stormwaters are drained from the service area by a separate system.

The Laguna County Sanitation District WTP is designed to provide secondary treatment by means of biofiltration and its reported nominal ADWF capacity is 1.3 mgd.

Influent to the plant passes through comminuting devices operated in parallel and falls into an influent pumping station wet well; wastewaters are pumped to a single primary sedimentation tank with a diameter of 65 feet. Effluent from the primary clarifier flows to a control structure and pumped, together with recycled flow from the secondary clarifier, at a constant rate to the biofilter. The biofilter is 150 feet in diameter and has a rock depth of 3 feet. Effluent from the biofilter is returned in equal amounts to the primary and the secondary clarifiers. The primary and secondary clarifiers are the same size and are situated at the same elevation. A portion of the effluent from the secondary clarifier is returned to the control structure and the remainder of the flow is discharged to a chlorine contact chamber.

Primary and secondary sludges are pumped to a single anaerobic digester. The digester is heated and mixed with a draft tube. Digester supernatant is either returned directly to the primary clarifier or is disposed of to the sludge drying beds. Digested sludge is dried on the drying beds and is used as a soil conditioner.

Treated and disinfected plant effluent flows into two oxidation ponds and into a gravity land outfall for discharge either to land in the general vicinity of the plant or to the Green Canyon drainage ditch.

Present average daily dry weather flows to the plant are about 1.26 mgd, almost equal to the ADWF capacity of the existing plant. The District has proposed several improvements designed to increase the plant's capacity and facilitate its operation. Included in those improvements are the installation of a variable speed influent pump, the construction of grit removal facilities and a secondary digester, the cleaning and installation of gas mixing in the existing digester, the installation of a railing around the top of the existing digester, the installation of chlorine mixing and a contact chamber, the deepening of the existing ponds and the installation of floating aerators and the provision of effluent screening facilities. The project cost of those improvements is estimated at $450,000 (ENR 1900).

The District has under construction facilities that will allow for effluent disposal by spray irrigation on 465 acres of nearby pasture land. The implementation of this and the above proposed projects are necessary if a flexible and reliable treatment and disposal system is to result.

Santa Maria Public Airport

The Santa Maria Public Airport owns and operates a wastewater collection system and a wastewater treatment plant which serves the airport, the industrial development within the airport boundaries and a small residential area to the east of the airport proper. Most of the existing collection system was constructed during World War II. Trunk sewers range in size from 10 to 18 inches. An 18-inch vitrified clay interceptor conveys the wastewater from the collection system by gravity to the Santa Maria Public Airport WTP. In 1972, wastewater flows averaged 0.31 mgd during dry weather. Stormwaters are drained from the service area by a separate system.

The wastewater treatment plant is designed to provide secondary treatment by means of biofiltration to an ADWF of 0.75 mgd. The plant consists of an inlet structure and bar screen, a primary sedimentation tank, two biofilters, a final sedimentation tank and an anaerobic sludge digester. Treated effluent is chlorinated and is used to irrigate pasture.

Insufficient data are available to determine the extent of storm inflow to the Santa Maria Public Airport sewerage system. The age of the system would indicate, however, that a thorough analysis of infiltration to the system should be accomplished.

In general, the treatment plant is in poor condition. Much of the mechanical equipment should be replaced. Airport representatives have indicated their desire to abandon the plant and discharge their wastes to either the City of Santa Maria or the Laguna County Sanitation District System.

The existing plant currently has certain deficiencies which can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the primary sedimentation tank.

2. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality.

3. An auxiliary power supply is not available.

4. The distributor arm of one of the biofilters is inoperable.

The Santa Maria Public Airport is required to meet discharge requirements promulgated by the Regional Board in 1971. It is in compliance with those requirements.

Alternative Municipal Wastewater Management Plans — Santa Maria River Sub-Basin

Alternative plans involving degrees of consolidation of treatment and disposal functions, ocean disposal, land disposal by spray irrigation and percolation and stream disposal have been investigated for the Santa Maria Valley area. Utilizing the assessment of environmental sensitivity presented earlier in Chapter 6, three basic alternative plans, each of which includes several subalternatives, and a no action alternative were developed: Alternative I consists of valley-wide consolidation of existing dischargers at a new regional WTP with either land, or ocean disposal; Alternative II consists of the consolidation of two existing dischargers at the City of Santa Maria WTP with either land or ocean disposal; Alternative III consists of upgrading and enlarging each of the existing WTP's in the area.

No Action Alternative. The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped, or significantly curtailed, and the current means of wastewater management, with its deficiencies continued.

Alternative I. Alternative I is a valley-wide consolidation alternative. The community of Nipomo will be sewered and wastewaters will be conveyed from Nipomo, the City of Guadalupe, the City of Santa Maria, the Santa Maria Public Airport and the Laguna County Sanitation District to a regional WTP near Guadalupe. Existing municipal wastewater treatment plants will be abandoned and treatment appropriate for either ocean discharge or percolation into the groundwater aquifer will be provided.

For ocean disposal both physical-chemical and biological secondary treatment are investigated. For planning purposes it is assumed that disposal will be by means of an ocean outfall with a multiport diffuser beginning at 1,000 feet offshore of 35 feet of depth (MSL).

Land disposal by percolation will occur on acceptable soils outside of the present and planned future urban acres. It is assumed that nitrogen removal, a strict source control program and either partial demineralization or lime-soda softening of municipal water supplies or partial demineralization of the wastewater will be required to protect the groundwater basin. Preliminary estimates of the cost of partial demineralization of municipal water supplies far exceeded the cost of lime-soda softening and, therefore, no further consideration was given partial demineralization of municipal water supplies. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-11. The estimated project costs of the facilities required for this alternative are given in Table 16-29.

Alternative II. Alternative II includes the conveyance of wastewaters from the Santa Maria Public Airport to the enlarged and upgraded City of Santa Maria WTP or to an enlarged and upgraded Laguna County Sanitation District WTP. Either option is acceptable. The Laguna County Sanitation District WTP will be expanded, its treatment process upgraded and its effluent disposed of by percolation at the plant site and by spray irrigation. The City of Guadalupe WTP will be expanded and upgraded. Plant effluent will be disposed of in percolation basins adjacent to the WTP and will be available for agricultural irrigation use. For the community of Nipomo this alternative includes sewering the community, constructing a WTP and disposing of treated wastewater by percolation. A preliminary estimate of the cost of facilities required for stream disposal by the City of Guadalupe and Nipomo revealed that the cost of stream disposal is appreciably greater than percolation. For that reason stream disposal was not considered further. The required treatment levels for this alternative are the same as in Alternative I. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-11. The estimated costs of the facilities required for this alternative are given in Table 16-29.

Alternative III. Alternative III consists of enlarging and upgrading all of the existing wastewater treatment plants. Either the community of Nipomo will be sewered and a WTP constructed or the community will remain essentially unsewered and its population density controlled. Disposal options for the City of Santa Maria include ocean disposal and percolation. Disposal options for the City of Guadalupe include perco-

Table 16-29. Evaluation of Economic Factors of Alternatives, Santa Maria Valley Region, Thousands of Dollars[a]

	Alternative I				Alternative II					Alternative III				
	Ocean disposal		Percolation		Ocean disposal	Percolation		Spray irrigation		Ocean disposal	Percolation		Spray irrigation	
Factor/service area	Level I[c]	Level II[d]	Level VII[e]	Level VIII[f]	Level II[d]	Level VII[c]	Level VIII[f]	Level VII[e]	Level VIII[f]	Level II[d]	Level VII[e]	Level VIII[f]	Level VII[e]	Level VIII[f]
Capital cost[b]														
Nipomo														
Wastewater facilities[h]	7,100	7,200	7,100	7,300	NA	3,200	3,300	NA	NA	NA	3,100	3,300	NA	NA
City of Guadalupe														
Water treatment	0	0	1,200	0		1,200	0				1,300	0		
Wastewater facilities	1,500	1,600	1,500	1,600		700	1,100				700	1,100		
Subtotal	1,500	1,800	2,700	1,600	NA	2,000	1,100	NA	NA	NA	2,000	1,100	NA	NA
City of Santa Maria														
Water treatment	0	0	8,900	0	0	8,900	0			0	8,900	0		
Wastewater facilities	20,300	23,300	20,600	24,200	18,400	12,700	16,400			19,700	12,900	16,900		
Subtotal	20,300	23,300	29,500	24,200	18,400	21,600	16,400	NA	NA	19,700	21,800	16,900	NA	NA
Santa Maria Public Airport District														
Water treatment	0	0	1,900	0	0	1,900	0						1,900	0
Wastewater facilities	2,600	3,000	2,700	3,100	3,100	2,500	2,900						4,900	5,500
Subtotal	2,600	3,000	4,600	3,100	3,100	4,400	2,900	NA	NA	NA	NA	NA	6,800	5,500
Laguna County Sanitation District														
Water treatment	0	0	5,900	0				5,900	0				5,900	0
Wastewater facilities	11,300	12,200	11,400	12,500				5,000	6,200				5,000	6,200
Subtotal	11,300	12,200	17,300	12,500	NA	NA	NA	10,900	6,200	NA	NA	NA	10,900	6,200
Total	42,800	47,300	61,200	48,700	NA	42,900	29,900	NA	NA	NA	44,600	33,000	NA	NA
Water treatment	0	0	17,900	0		18,000	0				18,000	0		
Wastewater facilities	42,800	47,300	43,300	48,700		23,900[g]	29,900[g]				26,600[g]	33,000[g]		
Total annual cost														
Nipomo														
Wastewater facilities[h]	500	500	500	540	NA	290	350	NA	NA	NA	290	350	NA	NA
City of Guadalupe														
Water treatment	0	0	150	0		150	0				150	0		
Wastewater facilities	120	130	140	190		140	220				140	220		
Subtotal	120	130	290	190	NA	290	220	NA	NA	NA	290	220	NA	NA
City of Santa Maria														
Water treatment	0	0	1,030	0	0	1,030	0			0	1,030	0		
Wastewater facilities	1,850	2,000	1,990	2,170	1,710	1,480	2,230			1,820	1,520	2,310		
Subtotal	1,850	2,000	3,020	2,170	1,710	2,510	2,230	NA	NA	1,820	2,550		NA	NA
Santa Maria Public Airport District														
Water treatment	0	0	220	0	0	220	0						220	0
Wastewater facilities	200	270	270	370	280	270	370						500	790
Subtotal	200	270	490	370	280	490	370	NA	NA	NA	NA	NA	720	790
Laguna County Sanitation District														
Water treatment	0	0	720	0				720	0				720	0
Wastewater facilities	950	990	1,000	1,280				620	990				680	990
Subtotal	950	990	1,720	1,280	NA	NA	NA	1,400	990	NA	NA	NA	1,400	990
Total	3,620	3,890	6,020	5,090	NA	4,980	4,160	NA	NA	NA	5,250	4,660	NA	NA
Water treatment	0	0	2,120	0		2,120	0				2,120	0		
Wastewater facilities	3,620	3,890	3,900	5,090		2,860[g]	4,160[g]				3,130[g]	4,660[g]		

[a] Costs based on an ENR Construction Cost Index of 2000.
[b] Costs of staged construction of facilities required to meet projected water and wastewater demands until year 2000. The cost of water treatment consists of the total capital cost of the staged construction of lime-soda water softening plants with a design capacity equal to twice the average annual municipal water demand. The above cost estimates assume that each service area will construct a separate softening plant.
[c] Level I = primary sedimentation with chemical addition, disinfection and dechlorination.
[d] Level II = biological secondary treatment, disinfection and dechlorination.
[e] Level VII = lime-soda softening of water supply to a hardness of 100 mg/l as $CaCO_3$, wastewater treatment by biological oxidation with nitrification, denitrification (nitrogen removal) and disinfection.
[f] Level VIII = biological oxidation with nitrification, denitrification, effluent filtration, partial demineralization to TDS = 900 mg/l, disinfection.
[g] Total includes combination spray irrigation, percolation disposal option for Laguna County Sanitation District.
[h] Includes cost of sewering developed area.

Table 16-29. Evaluation of Economic Factors of Alternatives, Santa Maria Valley Region, Thousands of Dollars[a] (continued)

Factor/service area	Alternative I				Alternative II					Alternative III				
	Ocean disposal		Percolation		Ocean disposal	Percolation		Spray irrigation		Ocean disposal	Percolation		Spray irrigation	
	Level I[c]	Level II[d]	Level VII[e]	Level VIII[f]	Level II[d]	Level VII[c]	Level VIII[f]	Level VII[e]	Level VIII[f]	Level II[d]	Level VII[e]	Level VIII[f]	Level VII[e]	Level VIII[f]
Present worth[b]														
Nipomo														
Wastewater facilities"	6,300	6,300	6,300	6,800	NA	3,500	4,300	NA			3,500	4,300		
City of Guadalupe														
Water treatment	NA	NA	1,800	NA		1,800	NA				1,800	NA		
Wastewater facilities	1,700	1,700	1,700	2,300		1,700	2,700				1,700	2,700		
Subtotal	1,700	1,700	3,500	2,300	NA	3,500	2,700	NA	NA	NA	3,500	2,700	NA	NA
City of Santa Maria														
Water treatment	NA	NA	11,100	NA	NA	11,100	NA			NA	11,100	NA		
Wastewater facilities	20,500	22,800	21,600	30,000	18,800	14,900	23,900			19,400	15,400	24,700		
Subtotal	20,500	22,800	32,700	30,000	18,800	26,000	23,900	NA	NA	19,400	26,500	24,700	NA	NA
Santa Maria Public Airport District														
Water treatment	NA	NA	2,300	NA	NA	2,300	NA						2,300	NA
Wastewater facilities	3,000	3,100	3,000	4,300	3,300	3,000	4,300						5,400	9,100
Subtotal	3,000	3,100	5,300	4,300	3,300	5,300	4,300	NA	NA	NA	NA	NA	7,700	9,100
Laguna County Sanitation District														
Water treatment	NA	NA	7,900	NA				7,900	NA				7,900	NA
Wastewater facilities	11,600	11,900	11,700	14,900				7,300	11,000				7,300	11,000
Subtotal	11,600	11,900	19,600	14,900	NA	NA	NA	15,200	11,000	NA	NA	NA	15,200	11,000
Total	44,100	45,800	67,400	58,300	NA	48,300	46,200	NA	NA		58,500	51,800	NA	NA
Water treatment	NA	NA	23,100	NA		25,200	NA				25,200	NA		
Wastewater facilities	44,100	45,800	44,300	58,300		23,100[g]	46,200[g]				33,300[g]	51,800[g]		
Initial local annual financial burden[b]														
Nipomo														
Wastewater facilities[h]	120	120	120	150	NA	100	130	NA	NA	NA	100	130	NA	NA
City of Guadalupe														
Water treatment	NA	NA	60	NA		60	NA				60	NA		
Wastewater facilities	50	50	50	80		80	120				80	120		
Subtotal	50	50	110	80	NA	140	120	NA	NA	NA	140	120	NA	NA
City of Santa Maria														
Water treatment	NA	NA	340	NA	NA	340	NA			NA	340	NA		
Wastewater facilities	550	540	540	960	520	470	800			530	490	820		
Subtotal	550	540	880	960	520	810	800	NA	NA	530	810	820	NA	NA
Santa Maria Public Airport District														
Water treatment	NA	NA	60	NA	NA	60	NA						60	NA
Wastewater facilities	70	70	80	130	80	80	120						150	210
Subtotal	70	70	140	130	80	140	120	NA	NA	NA	NA	NA	210	210
Laguna County Sanitation District														
Water treatment	NA	NA	220	NA				220	NA				220	NA
Wastewater facilities	240	240	240	370				220	330				220	330
Subtotal	240	240	460	370	NA	NA	NA	440	330	NA	NA	NA	440	330
Total	1,010	1,020	1,710	1,690	NA	1,480	1,500	NA	NA	NA	1,420	1,610	NA	NA
Water treatment	NA	NA	680	NA		750	NA				750	NA		
Wastewater facilities	1,010	1,020	1,030	1,690		730[g]	1,500[g]				670[g]	1,610[g]		

[a]Costs based on an ENR construction cost index of 2000.
[b]The cost of water treatment is based on staged construction of lime-soda water softening plants with a design capacity equal to twice the average annual municipal water demand. The above cost estimates assume that each service area will construct a separate softening plant.
[c]Level I = primary sedimentation with chemical addition, disinfection and dechlorination.
[d]Level II = biological secondary treatment, disinfection and dechlorination.
[e]Level VII = lime-soda softening of water supply to a hardness of 100 mg/l as $CaCO_3$, wastewater treatment by biological oxidation with nitrification, denitrification (nitrogen removal) and disinfection.
[f]Level VIII = biological oxidation with nitrification, denitrification, effluent filtration, partial demineralization to TDS = 900 mg/l, disinfection.
[g]Total includes combination spray irrigation, percolation disposal option for Laguna County Sanitation District.
[h]Includes cost of sewering developed area.

NA = not applicable

lation and spray irrigation. Appropriate disposal options for the City of Santa Maria include ocean disposal and percolation. For the Santa Maria Public Airport District, only spray irrigation with storage is considered appropriate and, because of poor soils, a unit land requirement of 200 acres per mgd is assumed. The disposal option considered for the Laguna County Sanitation District includes a combination of percolation and spray irrigation. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-11. The estimated project costs of the facilities required for this alternative are given in Table 16-29.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to import wastewaters from neighboring sub-basins, plans for ocean disposal for small dischargers, and plans for locating percolation basins near the coast.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge. The potential for each reuse is discussed below.

Agriculture. Irrigated agriculture is and is expected to continue to be a major land use in the Santa Maria Valley. Significantly, several of the crops grown in the Valley are especially tolerant to high salinity irrigation water. Plans which encourage this reuse are to be favored and the potential for the reuse should be investigated at the project level.

Recreation and Land Beautification. Because of the highly porous Valley soils, the creation of recreational impoundments is not likely. With the exception of the golf course near the Laguna County Sanitation District WTP, there are few landscaped areas with significant irrigation demand near existing or proposed WTP sites.

Industry. Several industries which exert a high water demand exist in the Santa Maria Valley. Investigation of the feasibility of the reuse should be conducted at the project planning level.

Domestic Use. It is highly unlikely that direct domestic reuse, which is presently prohibited by the State Department of Health, will be implemented until all sources of new water supply have been exhausted. In the event that planned programs to import water are not implemented or fail to meet the ultimate needs of the area, the first step would be to substitute reclaimed water for the potable supplies now used for agriculture, recreation and land beautification purposes. Only then is consideration likely to be given to the reclamation of wastewater for domestic use. On the basis of present conditions, therefore, it must be concluded that this form of water reuse may not need to be considered in detail for many years.

Streamflow Augmentation. Because the Santa Maria River and its tributaries are ephemeral in character, streamflow augmentation during the dry months would provide riparian habitat. The permeability of much of the Santa Maria River streambed, however, would require that a very high flow be released for a significant amount of habitat to be provided. Most of the water discharged to the streambed during the summer months would infiltrate into the ground a short distance downstream of its point of input.

Groundwater Recharge. Due to the extensive use of groundwater in the study area, reclamation of wastewater through groundwater recharge would be of considerable benefit to the area. Due to the porous nature of soils in the Valley, extensive areas are available for percolation basins.

If groundwater mining is considered a viable alternative water supply for this area, reclaimed wastewater could possibly be injected into the ground along the coast to provide a barrier to seawater intrusion. Because of the width of the mouth of the Valley and because of a partial aquiclude near the coast, the use of percolation basins to create a seawater barrier would probably prove infeasible. The width of the Valley near the

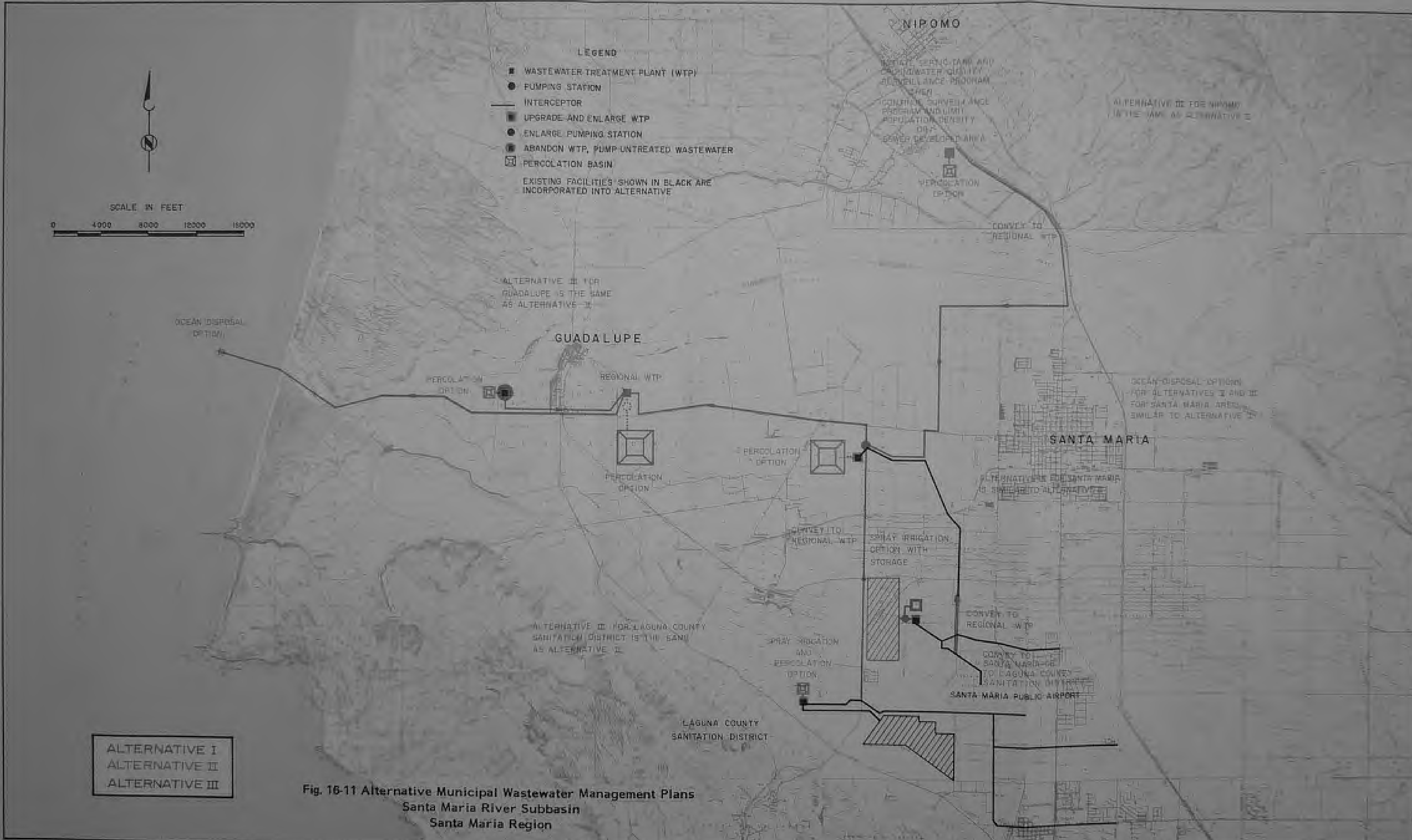


Fig. 16-11 Alternative Municipal Wastewater Management Plans
Santa Maria River Subbasin
Santa Maria Region

coast discourages even the use of injection wells to form a seawater intrusion barrier, but this reuse should be considered at the project level.

Summary. The previous discussion has indicated that the outlook may be favorable for reuse of reclaimed water for agricultural irrigation, industry and particularly for groundwater recharge. Plans for wastewater treatment and disposal which favor these reuse options should be favored.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

In Table 16-29 the cost of wastewater treatment and disposal facilities and the cost of water treatment facilities for the Santa Maria Valley Region are broken out of the total cost of the wastewater management plans. This breakdown allows the reader to compare both the total cost and the cost of wastewater facilities among the alternatives. This is necessary because in this area, the alternatives are not designed to just protect the beneficial uses of the receiving waters. It was found that in this region a more cost-effective means of controlling wastewater mineral quality for land disposal might be to centrally lime-soda soften municipal water supplies. This would not only significantly lower the TDS of the water supplied to the consumer, but it would make unnecessary the use of home ion-exchange water softeners which release brines to the sewerage systems. Thus a strict salt source control program could be easily implemented. As was illustrated earlier in this Chapter, the combination of lime-soda softening and a strict source control program could eliminate completely the municipal contribution of salts to a groundwater basin which is already in a state of adverse salt balance.

The only discharger of municipal wastewater in the Cuyama Valley Region is Cuyama Valley Community Services, Incorporated, a privately owned utility. After secondary treatment, wastewater is presently being discharged to the Cuyama River. Alternative plans involving percolation and spray irrigation and a no action alternative were developed: Alternative I consists of the construction of facilities needed for land disposal by percolation; Alternative II consists of the construction of facilities needed for land disposal by means of spray irrigation with storage. Disposal to the Cuyama River or its tributaries above Twitchell Reservoir is not considered an appropriate disposal option.

The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped or significantly curtailed, and the current means of wastewater management, with its deficiencies, continued.

Alternative I for Cuyama consists of upgrading the existing wastewater treatment plant and the containment of treated wastewater in percolation basins. Because groundwater nitrate problems have occurred in the Valley, it is assumed that biological nitrification plus denitrification will be necessary for percolation into porous soils.

Control of wastewater TDS content can be accomplished by either partially demineralizing the community's water supply or possibly by drilling exploratory wells to find a higher quality groundwater supply coupled with a strict salt source control program. Partial demineralization of the wastewater flow is a third strategy.

Alternative II for Cuyama consists of upgrading the existing wastewater treatment plant with disposal by means of spray irrigation. Biological secondary treatment would be an appropriate level of treatment if spray irrigation occurred on light soils downstream of domestic water supply wells. The addition of nitrogen removal facilities may be necessary at some future date if groundwater quality monitoring revealed groundwater nitrate impairment. Control of water and wastewater TDS content will be necessary in either case.

Comparison of Alternatives – Santa Maria River Sub-Basin

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, and functional characteristics of the alternatives is also accomplished.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 for the Santa Maria Valley Region is presented in Table 16-29. Costs for the Cuyama Valley Region are included in Table 16-30.

A comparison of the overall capital cost of the alternatives for the Santa Maria Valley indicates that Alternative II with land disposal and wastewater nitrogen removal and partial demineralization is the least costly alternative. Comparing just the cost of wastewater facilities, however, Alternative II with water softening and wastewater nitrogen removal is the least costly alternative. The capital cost of water supply softening for wastewater mineral control exceeds the capital cost of wastewater demineralization, but the direct benefits of a softened water supply have not been quantified in this analysis.

For the City of Santa Maria, the total capital cost of Alternatives II or III with land disposal and water supply softening is less than 20 percent more costly than Alternatives II or III with ocean disposal. The ocean disposal options do not include the costs or benefits of water softening because wastewater mineral control would not be necessary for ocean disposal.

For the Santa Maria Public Airport District, Alternative II, which consists of consolidation with the City of Santa Maria, would involve less capital expenditure than would Alternative III which consists of local treatment and disposal.

The alternative with the least total annual cost is Alternative I with ocean disposal. The ocean disposal option of this alternative is, in general, less expensive than alternatives which involve less consolidation because of the lower operation and maintenance costs of Level I and II treatment. In some cases, however, the total annual cost of Alternative I is higher than the total annual cost of Alternatives II and III because of the increased costs due to the conveyance of wastewater to a new regional WTP and because all existing WTP's would be abandoned. The total annual costs of the land disposal options of Alternative I, for instance, are higher than the total annual costs of the land disposal options of Alternatives II and III because savings in costs due to the economy of scale of a single larger regional WTP is more than matched by the higher costs of wastewater conveyance.

Considering just the total annual cost of wastewater conveyance, treatment and disposal facilities, Alternative II with land disposal and water softening for wastewater mineral control is the least costly alternative. This is the case because with Alternative II the larger existing WTP's are utilized to the greatest extent feasible. For the City of Santa Maria and the Santa Maria Public Airport, the total annual cost of wastewater facilities for Alternative II is less than the total annual cost of Alternative III. For the City of Santa Maria, the total annual cost of the wastewater facilities for land disposal with water softening is less than the total annual cost of the facilities required for ocean disposal. Also because land disposal with water softening involves a much lower initial capital investment for wastewater facilities than does ocean disposal, the present worth and initial local annual financial burden of wastewater facilities is much less.

Feasibility level estimates for Cuyama indicate that the capital cost of disposal by spray irrigation with storage would exceed the cost of disposal to percolation basins. The total annual costs of the two disposal options are comparable, however.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rates. The analysis of the functional factors of the alternatives for each service area in the Santa Maria Valley Region is presented in Table 16-31; The Cuyama Region is rated in Table 16-32. In general, Alternative II is rated higher than the other Alternatives for the Santa Maria Valley. Among the disposal options within Alternative II, the percolation option with water softening and wastewater nitrogen removal is rated highest. For the City of Santa Maria, for example, it is considered much more cost effective to control wastewater mineral content by softening the municipal water supply utilizing the lime-soda process combined with a strict salt source control program rather than partially demineralizing the community's wastewater. The staged construction of wastewater facilities required for land disposal allows greater flexibility with regard to changes in the expected rate of population growth and also with respect to

Table 16-30. Evaluation of Economic Factors of Alternatives, Cuyama Valley Region, Thousands of Dollars[a]

Service area/Factor	Alternative I: Percolation	Alternative II: Spray Irrigation with Storage
Cuyama Valley Community Services, Incorporated		
Capital cost[b]	160	250
Annual cost	30	30
Present worth	400	500
Initial local annual financial burden	20	20

[a]Costs based on an ENR Construction Cost Index of 2000.
[b]Costs of staged construction of facilities required to meet projected wastewater demand until the year 2000.

Table 16-32. Evaluation of Functional Factors of Alternatives, Cuyama Valley Region

Service area/factor	No action	Alternative I: Percolation	Alternative II: Spray irrigation with storage
Cuyama Valley Community Services, Incorporated			
Effectiveness	Poor	Excellent	Excellent
Reliability	Poor	Adequate	Adequate
Flexibility	Marginal	Adequate	Adequate
Implementation	Poor	Adequate	Adequate
Reclamation potential	Marginal	Excellent	Excellent
Compatability	Poor	Excellent	Excellent
Overall rating	Poor	Excellent	Excellent

Table 16-31. Evaluation of Functional Factors of Alternatives, Santa Maria Valley Region

		Alternative I				Alternative II					Alternative III				
		Ocean disposal		Percolation		Ocean disposal	Percolation		Spray irrigation		Ocean disposal	Percolation		Spray irrigation	
Service area/factor	No action	Level I[c]	Level II[d]	Level VII[c]	Level VIII[t]	Level II[d]	Level VII[c]	Level VIII[t]	Level VII[c]	Level VIII[t]	Level II[d]	Level VII[c]	Level VIII[t]	Level VII[c]	Level VIII[t]
Nipomo															
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	NA[a]	Excellent	Marginal	NA	NA	NA	Excellent	Marginal	NA	NA
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Flexibility	Marginal	Poor	Poor	Poor	Poor	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Implementation	Poor	Poor	Poor	Poor	Poor	NA	Adequate	Marginal	NA	NA	NA	Adequate	Marginal	NA	NA
Reclamation potential	Poor	Marginal	Marginal	Adequate	Adequate	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Compatibility	Poor	Poor	Poor	Poor	Poor	NA	Excellent	Adequate	NA	NA	NA	Excellent	Adequate	NA	NA
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	NA	Excellent	Adequate	NA	NA	NA	Excellent	Adequate	NA	NA
City of Guadalupe															
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	NA	Excellent	Marginal	NA	NA	NA	Excellent	Marginal	NA	NA
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Flexibility	Marginal	Poor	Poor	Poor	Poor	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Implementation	Poor	Poor	Poor	Poor	Poor	NA	Adequate	Marginal	NA	NA	NA	Adequate	Marginal	NA	NA
Reclamation potential	Marginal	Marginal	Marginal	Adequate	Adequate	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent	NA	NA
Compatibility	Poor	Poor	Poor	Poor	Poor	NA	Excellent	Adequate	NA	NA	NA	Excellent	Adequate	NA	NA
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	NA	Excellent	Adequate	NA	NA	NA	Excellent	Adequate	NA	NA
City of Santa Maria															
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	Marginal	Excellent	Poor	NA	NA	Marginal	Excellent	Poor	NA	NA
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	NA	NA	Adequate	Adequate	Adequate	NA	NA
Flexibility	Marginal	Poor	Poor	Poor	Poor	Poor	Excellent	Excellent	NA	NA	Poor	Excellent	Excellent	NA	NA
Implementation	Poor	Poor	Poor	Poor	Poor	Adequate	Adequate	Poor	NA	NA	Adequate	Adequate	Poor	NA	NA
Reclamation potential	Adequate	Marginal	Marginal	Adequate	Adequate	Adequate	Excellent	Excellent	NA	NA	Adequate	Excellent	Excellent	NA	NA
Compatibility	Poor	Poor	Poor	Poor	Poor	Adequate	Excellent	Adequate	NA	NA	Adequate	Excellent	Adequate	NA	NA
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	Adequate	Excellent	Marginal	NA	NA	Adequate	Excellent	Marginal	NA	NA
Santa Maria Public Airport District															
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	Marginal	Excellent	Poor	NA	NA	NA	NA	NA	Marginal	Poor
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	NA	NA	NA	NA	NA	Adequate	Adequate
Flexibility	Marginal	Poor	Poor	Poor	Poor	Poor	Excellent	Excellent	NA	NA	NA	NA	NA	Adequate	Adequate
Implementation	Poor	Poor	Poor	Poor	Poor	Adequate	Adequate	Poor	NA	NA	NA	NA	NA	Poor	Poor
Reclamation potential	Marginal	Marginal	Marginal	Adequate	Adequate	Marginal	Excellent	Excellent	NA	NA	NA	NA	NA	Adequate	Excellent
Compatibility	Poor	Poor	Poor	Poor	Poor	Adequate	Excellent	Adequate	NA	NA	NA	NA	NA	Poor	Poor
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	Marginal	Excellent	Marginal	NA	NA	NA	NA	NA	Marginal	
Laguna County Sanitation District															
Effectiveness	Poor	Marginal	Marginal	Marginal	Marginal	NA	NA	NA	Excellent	Poor	NA	NA	NA	Excellent	Poor
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	NA	NA	NA	Adequate	Adequate	NA	NA	NA	Adequate	Adequate
Flexibility	Marginal	Poor	Poor	Poor	Poor	NA	NA	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent
Implementation	Poor	Poor	Poor	Poor	Poor	NA	NA	NA	Adequate	Poor	NA	NA	NA	Adequate	Poor
Reclamation potential	Adequate	Marginal	Marginal	Adequate	Adequate	NA	NA	NA	Excellent	Excellent	NA	NA	NA	Excellent	Excellent
Compatibility	Poor	Poor	Poor	Poor	Poor	NA	NA	NA	Excellent	Adequate	NA	NA	NA	Excellent	Adequate
Overall rating	Poor	Marginal	Marginal	Marginal	Marginal	NA	NA	NA	Excellent	Marginal	NA	NA	NA	Excellent	Marginal

[a] NA - not applicable

possible future changes in water quality management. The long and expensive land and ocean outfalls would build a great deal of inflexibility into the wastewater management system. A staged program of wastewater treatment plant upgrading, however, would leave a greater number of disposal options open. Thus, when the recommended water quality model of the groundwater basin is developed and verified, options for wastewater disposal will not have been foreclosed.

In the Cuyama Region, based on functional factors, Alternatives I and II are preferable to the No Action Alternative.

SAN ANTONIO CREEK SUB-BASIN

The San Antonio Creek Sub-basin lies in the west-central part of Santa Barbara County and is bounded on the north by the Solomon and Casmalia Hills and on the south by the Purisma Hills. There are presently no municipal sewerage systems in the sub-basin. Waste loads are imposed on the receiving waters of the sub-basin by about 3,900 acres of irrigated agriculture, by low density stock grazing, by oil and gas production, by individual waste disposal systems, by urban and nonurban runoff and by vessel use and recreation. A portion of Vandenberg AFB extends into this sub-basin, but most of its municipal wastes are sewered to a WTP in the Santa Ynez River watershed. Most of the individual waste disposal systems occur in the communities of Los Alamos, Harriston and Casmalia.

Because the population and economic forecasts presented in Chapter 12 suggest that no significant increases in development will occur during the study period, no specific management plan has been formulated. The management plan for unsewered areas such as Los Alamos, Harriston and Casmalia is discussed under individual disposal systems, see Chapter 5.

SANTA YNEZ RIVER SUB-BASIN

The Santa Ynez River Sub-basin extends from the coast to the eastern boundary of Santa Barbara County and is bordered on the south by the Santa Ynez Mountains and on the north by the Purisma Hills and the San Rafael Mountains. Agricultural and urban land uses predominate in the two wide valley regions identified in this report as the Lompoc Valley and the Upper Santa Ynez Valley.

Lompoc Valley Region

The Lompoc Valley Region encompasses the Lompoc and Santa Rita hydrologic sub-units. There are presently five dischargers of municipal wastewater in the region: the City of Lompoc, Vandenberg Disposal Company (Vandenberg Village), Lompoc Utility Services Company (Mission Hills) Federal Correctional Institute (FCI) and Vandenberg Air Force Base.

Vandenberg Air Force Base

Vandenberg Air Force Base is located on a mesa overlooking the mouth of the Santa Ynez River in Santa Barbara County. The base is divided into north and south cantonment areas by the flood plain of the Santa Ynez River. The main cantonment area is located on a gently sloping mesa between the Santa Ynez River to the south and San Antonio Creek to the north. That area is served by several individual waste treatment systems. The main base sewerage system collects treats and disposes of almost all of the wastewaters generated on the base.

The main collection system consists of 543,000 feet of 8 to 21 inch gravity sewers. There are four wastewater lift stations in the system. The sewers in the cantonment area proper were constructed in 1941 and the sewers in the family housing areas were installed in the 1960's. Stormwater is drained from the service area by a separate system.

In 1972, the resident population of the base was about 12,000 and about 9,000 employees commuted to the base daily. Pretreated industrial wastes are discharged to the system at several points. Industrial waste producing activities include missile maintenance, aircraft maintenance, automotive maintenance, photographic processing and metal cleaning and plating.

The south cantonment area is served by two oxidation-percolation ponds with a design capacity of 0.11 mgd. The present flow to the ponds is estimated to be 35,000 gpd. Occasionally, during periods of wet weather discharge of chlorinated wastewater occurs to a ditch which flows to a lagoon at the mouth of the Santa Ynez River. All other remote areas of the base are served by individual collection, treatment and disposal systems. In 1973, there were 82 septic tanks with tile fields and 15 extended aeration plants with land disposal on the base.

The main Vandenberg Air Force Base WTP is designed to provide secondary treatment by biofiltration to an ADWF of 3.0 mgd. In 1972, the average daily dry weather flow was about 1.3 mgd. The plant was constructed in 1942 but all mechanical equipment, valves and filter rock have been replaced since 1968.

Influent wastewater passes either through a comminuting device or a manually cleaned bar screen prior to entering one of two grit removal channels. The channels are operated on alternate days and grit is removed manually. Influent wastewater is combined with a portion of the effluent of the primary trickling filter and introduced to the primary clarifier. The primary clarifier is 90 feet in diameter. Primary clarifier effluent is mixed with a portion of primary biofilter effluent and flows to the primary biofilter. From the primary biofilter, wastewater is pumped to the secondary biofilter and is mixed with a portion of secondary clarifier effluent. After secondary biofiltration, effluent is pumped to the secondary clarifier which is the same size as the primary clarifier. An amount equal to the influent flow to the plant is discharged from the secondary clarifier, is chlorinated, and enters the land portion of the system's ocean outfall. Chlorine contact occurs in the outfall pipe. The Air Force has estimated that about 70 minutes of chlorine contact is provided at a flow of 1.5 mgd. An automatic bypass has been provided which diverts primary effluent to the ocean outfall during power outages.

The land portion of the outfall consists of 18-inch vitrified clay pipe and the submarine portion is 18-inch welded steel pipe. The total length of the outfall is 14,415 feet; the submarine portion is about 1,020 feet in length. The ocean outfall terminates in a wye diffuser composed of two 10-foot lengths of 18-inch pipe set at a 90 degree angle to one another at 15 feet below mean sea level. Each leg of the diffuser contains eight 4-inch ports and a 4-inch port in the bulkhead at the end of each leg. The outfall rests unanchored on the ocean floor and its position shifts as the beach changes. It is reported by the base representatives that at times as much as 600 feet of the outfall pipe is unsupported.

The treatment plant has certain deficiencies which should be corrected. Those deficiencies include the following:

1. The plant does not have an auxiliary power supply at present, although the Air Force plans to provide one in the future.

2. The plant's chorine contact chamber is not used. It is not possible to monitor chlorine residual after a sufficient contact period at the plant site. It is possible but inconvenient to sample effluent at a manhole at the terminus of the land outfall.

3. Insufficient duplicate process units are provided to allow major units to be bypassed and repaired while still maintaining effluent quality. A single primary and a single secondary sedimentation tank are available.

The capacity of the Base's ocean outfall is expected to be sufficient beyond the year 2000. By the year 2000, peak flows from the Base are expected to reach 6 mgd.

The Vandenberg Air Force Base WTP ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State Ocean Plan. Computer simulation of the performance of the outfall indicates that the discharge will not meet the 100 to 1 initial dilution required by the Plan.

Federal Correctional Institution

The Federal Correctional Institution (FCI) is located about six miles northwest of the City of Lompoc on the southeastern portion of the former Camp Cooke Military Reservation. The facility was opened initially by the U.S. Army in 1947 as a Branch Disciplinary Barracks and the U.S. Department of Justice, Bureau of Prisons began operating the institution in August, 1959. FCI covers approximately 3,200 acres including the institution proper, surrounding buildings and a farm area. Industrial activities for the inmates include a slaughterhouse, an electronics cable shop, a furniture shop and a print shop. Wastewaters collected from the institution and a housing area located northeast of the institute proper, are conveyed through a 12-inch sewer to a treatment facility which was designed and constructed during World War II.

The FCI wastewater treatment plant provides secondary treatment by means of a biological trickling filter and an oxidation pond and has a design capacity of 0.3 mgd. Wastewater flows by gravity through a bar rack and a mechanical bar screen to a primary sedimentation tank with a diameter of 28 feet. Primary effluent flows to a single biological trickling filter with a diameter of 75 feet and an average rock depth of 6.5 feet Effluent from the filter receives further biological treatment and secondary sedimentation in two oxidation ponds with an effective area of 5.5 acres and a design water depth of 4 feet. The ponds provide 24 days of detention at design flow. Effluent from the ponds is chlorinated in a single chlorine contact tank; the tank provides a detention time of 38 minutes at design flow.

Primary sludge is pumped to a 24-foot diameter anaerobic digester. The digester is heated and has a floating top. Digested sludge is dried on 6 drying beds with a total area of 6,300 square feet and a depth of 2.5 feet. Dried sludge is ultimately used as a fertilizer or is hauled to a landfill. A portion of the chlorinated plant effluent is used for irrigation and the remainder of the flow is discharged to a water course tributary to the Santa Ynez River.

The collection and treatment facilities at the Federal Correctional Institution appear to be of adequate nominal capacity to serve the institution for several years. However, the existing plant has several deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. Insufficient influent screening facilities are available.

2. Much of the mechanical equipment is obsolete.

3. Inadequate facilities are available for mixing the anaerobic digester.

4. There is a lack of duplicate units that are necessary to permit shutdown of process units for repair and maintenance.

In summation, the plant will require extensive rehabilitation as well as new unit processes if it is to satisfy anticipated future effluent quality requirements.

City of Lompoc

The City of Lompoc now provides wastewater service to an area of approximatley 5.6 square miles. Land use in the community is predominantly residential with some commercial and light industrial development. Land use plans by the City call for a significant increase in light industrial and commercial development. The 1970 average dry weather flow to the system amounted to about 2.1 mgd from an estimated tributary population of about 24,000.

The wastewater system consists of sewers ranging in diameter from 6 to 30 inches and one small lift station of 1.5 mgd capacity. The service area slopes gradually to the northwest allowing the majority of wastewater to be collected and transported by gravity to the Lompoc Wastewater Treatment Plant (WTP). Stormwaters are drained from the service area by a separate system.

The Lompoc WTP provides secondary treatment by means of biological filtration and has an average dry weather flow (ADWF) capacity of 1.76 mgd. The existing treatment plant was initially designed and constructed to operate as a two-stage trickling filter system with discharge into the Santa Ynez River. Between 1961 and 1966, however, a number of modifications to the plant were undertaken, including the incorporation of a previously abandoned 35 acre-foot effluent oxidation pond into the system and the rerouting of return digester supernatant from the primary trickling filter to the primary sedimentation tank.

After the wastewater has passed through a comminuting screen, it is pumped to the primary sedimentation tank. The primary sedimentation tank is 85 feet in diameter.

Following primary sedimentation, flow continues through the plant by gravity with the primary filter recirculating 100 percent of the influent flow and with no recirculation through the secondary filter. The primary and secondary filters are both 85 feet in diameter with an average rock depth of 4.4 feet. Effluent from the secondary filter is discharged to the final sedimentation tank which is 55 feet in diameter.

Wastewater effluent is chorinated prior to discharge in a single chlorine contact tank. The tank has 2 baffles along its length and it provides a detention time of 31 minutes at design ADWF. Chlorination facilities are available for odor control prior to influent pumping, prior to the primary trickling filter and prior to the final clarifier. A small portion of the treated effluent is used for irrigation of the grounds while the remainder is discharged to the adjacent oxidation pond which has an effective area of 3.25 acres and a design water depth of 9 feet. Treated and disinfected plant effluent overflows from the oxidation pond to the Santa Ynez River.

Waste solid residues from the primary and final sedimentation processes are stabilized by anaerobic digestion. The digestion system consists of two 55-foot diameter digesters with floating covers. For higher efficiency, the digesters are heated to temperatures of 90-95 degrees F by recirculating sludge through an external heat exchanger and are mixed by sludge circulation. The digested sludge is transferred to four drying beds with a total area of 49,000 square feet which are provided with graded sand and aggregate material to allow for proper drainage. After drying, the sludge is removed from the beds and used as fertilizer. At present, disposal of the dried sludge has not been a problem, since the demand for its use as a fertilizer has been greater than its supply.

The treatment plant site is located adjacent to a bend of the Santa Ynez River and during the floods of January and February 1969 the site was inundated. The oxidation pond was completely washed out and there was about 18 inches of flood water in the operations building, however, no structures at the plant were destroyed. Downstream of the Lompoc Airport the river broke out of its confining terraces and covered most of the valley floor.

The wastewater treatment facilities presently serving the City of Lompoc are well situated to serve the bulk of the development anticipated for the Lompoc Valley. Moreover, the plant is not too distant from Robinson Street Bridge, where the groundwater basin, including the deep aquifer, may be recharged by spreading, an important consideration in any wastewater reuse plan. The plant was designed for future expansion and, because of conservative factors employed, many of the process units are adequate in size for greater loads than presently imposed on the facility. The existing unit processes are not, however, adequate to meet revised effluent requirements and must therefore be augmented in some fashion to produce effluent of the required quality. In addition, the plant has deficiencies which require correction, including the following:

1. The existing screening facilities are of inadequate size for anticipated future flows.

2. The size of inlet piping for the existing influent pumps limits the pumps' capacity to approximately half of their rating.

3. Many of the plant's processes are served by single units making it impossible to take a unit out of service for maintenance without shutting down the unit process and adversely affecting effluent quality.

4. The plant is not equipped with grit removal facilities and as a consequence all grit which is deposited in the primary sedimentation tank is pumped to the digesters.

5. The digesters are equipped with inadequate sludge circulation and mixing equipment. As a consequence, the tanks effective capacity has been reduced by grit deposits of up to 8 feet in depth and scum blankets of approximately the same magnitude.

6. Subsidence has caused serious structural damage to the plant's administration building, necessitating repairs in the very near future.

7. The plant site is not adequately protected against floods of the magnitude experienced during January and February 1969, nor against the Corps of Engineers standard project flood.

The City has proposed to correct these deficiencies in a project described in a recent project report.

The City of Lompoc WTP is required to be able to meet discharge requirements promulgated by the Regional Board in 1972 by June, 1975. When the proposed improvements to the plant are constructed and an effective source control program for such constituents as TDS, fluoride, boron and chloride is implemented, the discharge is expected to be in compliance with its discharge requirements. The concentrations of TDS, fluoride and choride in the plant effluent exceed the limits set by the Regional Board which must be met by June, 1975.

Alternative Municipal Wastewater Management Plans — Lompoc Valley Region

For the purpose of comparison of alternatives, it is assumed that the City of Lompoc's currently proposed regional wastewater management system will be constructed prior to the implementation of the recommended water quality management plan for the Lompoc Valley Region. The City's project calls for the conveyance of untreated wastewaters from the Vandenberg Disposal Company WTP and the Lompoc Utilities Services WTP to an enlarged and upgraded WTP at the site of the existing City of Lompoc WTP. The capacity of the City of Lompoc's WTP will be increased to 5.0 mgd and wastewater treatment will include biological nitrification with disinfection to MPN of 2.2 coliform organisms per 100 ml.

Disposal will be to the Santa Ynez River streambed. During the dry season, when a successful salt source control program has been implemented, reclaimed water will be conveyed to the Santa Ynez River streambed east of the City of Lompoc and used to recharge the groundwater basin. For a detailed explanation of the system and a detailed comparison of the alternatives considered, the reader is referred to the Lompoc Valley Regional Wastewater Management Study and Preliminary Design, June 1972.

Alternative plans involving degrees of consolidation of treatment and disposal functions, ocean disposal, stream disposal and land disposal by spray irrigation and percolation have been investigated. Utilizing the assessment of environmental sensitivity, two basic alternative plans, each of which contains several subalternatives, and a no action alternative were developed: Alternative I involves the conveyance of untreated wastewater from the Federal Correctional Institution (FCI) to the Lompoc Valley Regional WTP: Alternative II consists of enlarging and upgrading the existing treatment and disposal facilities.

No Action Alternative. The no action alternative consists of no upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted earlier would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and adverse environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped or significantly curtailed, and the current means of wastewater management, with its deficiencies, continued.

Alternative I. Alternative I consists of the conveyance of untreated wastewaters from FCI to the site of the existing City of Lompoc regional WTP. Wastewaters will undergo biological oxidation with nitrification and disinfection to an MPN of 2.2 coliform bacteria per 100 ml and dechlorination prior to disposal. For a detailed consideration of other disposal options the reader is referred to the Regional Wastewater Management Study mentioned previously.

The existing Vandenberg AFB WTP will be upgraded as necessary for ocean disposal, stream disposal or land disposal by spray irrigation. Disposal by percolation is not considered feasible for the AFB because of a high water table and low soil infiltration rates in the vicinity of the WTP. Biological secondary treatment with disinfection and dechlorination will be provided prior to ocean discharge. For planning purposes it is assumed that for ocean disposal, a new outfall will be constructed with a multiport diffuser commencing at 1000 feet beyond the 35-foot depth contour. Biological secondary treatment with disinfection and wet weather storage would be provided with the spray irrigation disposal option.

With stream disposal, wastewaters from the City of Lompoc WTP and from the Vandenberg AFB WTP will be discharged to the Santa Ynez River streambed. These discharges will occur a sufficient distance upstream to prevent a discharge to the lagoon at the river's mouth. It is assumed that such a discharge will require biological oxidation with nitrification and disinfection.

Disposal to the streambed of the Santa Ynez River in the vicinity of the City of Lompoc WTP will involve either planned or incidental recharge of the groundwater basin. Because such discharges have not caused nitrate impairment of groundwaters in the past, it is assumed that biological secondary treatment with disinfection will be appropriate for spray irrigation and biological oxidation with nitrification and disinfection will be appropriate for stream discharge near the City of Lompoc. With these disposal options, monitoring of the quality of local groundwaters will be necessary. If significant nitrate buildup does occur, nitrogen removal may be necessary at some time in the future. Disposal to the Santa Ynez River Bed will also require a reduction in the mass emission of salts. The City of Lompoc currently softens its public water supplies using the lime-soda process and is in the process of formulating a strict salt source control program. It is assumed that these programs will continue. If, in the future, groundwater quality monitoring reveals that the mass emission of salts is degrading groundwater quality, then partial demineralization of municipal wastewater effluents may be necessary. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-12. The estimated project costs of the facilities required for this alternative are given in Table 16-33.

Alternative II. Alternative II consists of enlarging and upgrading the existing wastewater systems at Vandenberg AFB, FCI and the City of Lompoc. Disposal options available to FCI include stream disposal and spray irrigation with storage. The disposal option for the City of Lompoc is stream disposal. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-12. The estimated project costs of the facilities required for this alternative are given in Table 16-33.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include ocean disposal plans for small inland dischargers, plans to construct percolation basins near the mouth of the Santa Ynez River, etc.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Possible uses for reclaimed water include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge. The potential for each reuse is discussed below.

Agriculture. Much of the usable land within the study area is devoted to irrigated agriculture. Agricultural irrigation, therefore, represents a potential use of reclaimed water provided it can be delivered at a cost commensurate with its value. Presently and historically, irrigation water in the Lompoc Valley has been supplied by groundwater through individual wells operated by the farmers. The cost of groundwater, therefore, is primarily dependent on power costs for pumping and capitalized costs of well and pumping facilities. If the pumping of poor quality groundwater from nearby wells must be discontinued, use of wastewater effluent should be considered as a practical alternative.

Recreation and Land Beautification. Land use plans call for the development of a large recreational area along the Santa Ynez River east of the City of Lompoc and for recreational areas in Vandenberg Village and south of Mission Hills. The freeway landscaping along the future realignment of State Highway I east of the City of Lompoc may also exert a significant demand for reclaimed wastewater. The cost of conveying reclaimed water to these areas solely for use for landscape irrigation is higher than the cost of locally available supplies, however.

Industry. Land use plans designate a substantial area for industrial development in the City of Lompoc. It is expected that the majority of these activities will be of the type conducted by relatively "dry" industries, which do not use large amounts of water. In considering future possibilities for the industrial use of reclaimed water within the study area each case will have to be evaluated individually considering the quality of water required for a specific application and the cost of producing reclaimed water of that quality.

Streamflow Augmentation. Because the Santa Ynez River and its tributaries are ephemeral in character, streamflow augmentation during the dry months would provide riparian habitat. The high permeability of most of the Santa Ynez River streambed, however, would require that a very high flow be released for a significant amount of habitat to be provided. Most of the water currently discharged to the Santa Ynez streambed during the summer months infiltrates into the ground a short distance downstream of its point of input.

Domestic Use. It is highly unlikely that direct domestic reuse, which is presently prohibited by the State Department of Health, will be implemented until all sources of new water supply have been exhausted. In the event that planned programs to import water are not implemented or fail to meet the ultimate needs of the area, the first step would be to substitute reclaimed water for the potable supplies now used for agriculture, recreation and land beautification purposes. Only then is consideration likely to be given to the reclamation of wastewater for domestic use. One the basis of present conditions, therefore, it must be concluded that this form of water reuse may not need to be considered in detail for many years.

Groundwater Recharge. Due to the extensive use of groundwater in the study area, reclamation of wastewater through groundwater recharge would be of considerable benefit to the area. In fact,

**Fig. 16-12 Alternative Municipal Wastewater Management Plans
Santa Ynez River Subbasin
Lompoc Region**

Table 16-33. Evaluation of Economic Factors of Alternatives, Lompoc Valley Region, Thousands of Dollars[a]

	Alternative I			Alternative II		
Factor/service area	Ocean disposal	Stream disposal	Spray irrigation with storage	Ocean disposal	Stream disposal	Spray irrigation with storage
Capital cost[b]						
Vandenberg Air Force Base	2,900[c]	3,600	3,500	2,900[c]	3,600	3,500
Federal Correctional Institution	NA	1,000	NA	NA	700	600
City of Lompoc	NA	900	NA	NA	900	NA
Vandenberg Disposal Company	NA	2,200	NA	NA	2,300	NA
Lompoc Utility Services	NA	1,000	NA	NA	1,000	NA
Total	NA	8,700	NA	NA	8,500	NA
Total annual costs						
Vandenberg Air Force Base	430[c]	510	500	430	510	500
Federal Correctional Institution	NA	90	NA	NA	100	100
City of Lompoc	NA	400	NA	NA	400	NA
Vandenberg Disposal Company	NA	260	NA	NA	270	NA
Lompoc Utility Services	NA	120	NA	NA	120	NA
Total	NA	1,380	NA	NA	1,400	NA
Present worth						
Vandenberg Air Force Base	5,300	6,200	5,600	5,300	6,200	5,600
Federal Correctional Institution	NA	1,000	NA	NA	1,200	1,300
City of Lompoc	NA	4,700	NA	NA	4,700	NA
Vandenberg Disposal Company	NA	2,400	NA	NA	2,500	NA
Lompoc Utility Services	NA	1,100	NA	NA	1,100	NA
Total	NA	15,400	NA	NA	15,700	NA
Initial local annual financial burden						
Vandenberg Air Force Base	400	520	420	400	520	420
Federal Correctional Institution	NA	80	NA	NA	90	90
City of Lompoc	NA	250	NA	NA	250	NA
Vandenberg Disposal Company	NA	80	NA	NA	80	NA
Lompoc Utility Services	NA	40	NA	NA	40	NA
Total	NA	970	NA	NA	980	NA

NA = not applicable

[a]Costs based on an ENR construction cost index of 2000.
[b]Costs of staged construction of facilities required to meet projected wastewater demand until the year 2000
[c]Based on the construction of a new ocean outfall. Capital cost of the extension of the present outfall would be $400,000 less and the total annual cost would be $30,000 less.

deterioration of the groundwater quality may be prevented by recharging quantities of higher quality effluent. Several areas suitable for recharge are located adjacent to and/or in the Santa Ynez River. Water reclamation for groundwater recharge in the Lompoc Valley has been the subject of a detailed investigation at the project level. Such a planned program of groundwater recharge is now being implemented by the City of Lompoc.

Summary. The previous discussion has indicated that the outlook may be favorable for reuse of reclaimed water for groundwater recharge. In the Lompoc area if a planned program for groundwater recharge in the Santa Ynez River east of the City is implemented, reclaimed water will be available for agriculture, freeway and park irrigation, and industrial use along the route of the transmission facilities.

Comparison of Alternatives — Lompoc Valley Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the recommended plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-33.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

For Vandenberg AFB the total capital and the total annual costs of ocean disposal are significantly less than the costs of either stream or land disposal. For the Federal Correctional Institution, the capital cost of joining the regional system after the system is constructed is higher than the cost of upgrading its existing facilities. The total annual cost of the facilities required to join the regional system, however, is less than the cost of upgrading and maintaining their existing facilities. This is the case because the economy of scale of utilizing a larger WTP more than matches the difference in the amortized capital costs. Cost estimates contained in the Lompoc Valley Regional Wastewater Management Study, which assume the FCI will join the regional system before the construction of the initial stage, indicate that it will be significantly less expensive for FCI to join the regional system rather than upgrade and maintain its own treatment and disposal system.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-24. In general ocean disposal for Vandenberg AFB is rated higher than the other disposal options and Alternative I for the Federal Correctional Institution is rated higher than Alternative II.

Upper Santa Ynez Valley Region

The Upper Santa Ynez Valley Region is composed of the Buellton and Santa Ynez Upland hydrologic subunits. There are presently three dischargers of municipal wastewater in the region: the Buellton Community Services District (Buellton), the Solvang Municipal Improvement District (Solvang), and the Cachuma County Sanitation District (Cachuma Recreation Area). There are three unsewered communities in the region: Santa Ynez, Los Olivos and Ballard, where individual waste disposal systems are used.

Buellton Community Services District

The community of Buellton is located just north of where State Highway 101 crosses the Santa Ynez River. Basically a residential community, Buellton's commercial activity centers on attracting motorists on Highway 101 to eat, rest and be entertained in the community. Five restaurants, eight motels, and Africa U.S.A., a small zoo, are served by the sanitary sewerage system. One of the restaurants, Anderson's, has been known to serve as many as 5,000 highway users in one day.

The community's wastewater collection system was constructed in 1959. It consists of 6 to 15-inch sewers that transport the wastewater by gravity to the wastewater treatment plant located adjacent to the Santa Ynez River. Stormwaters

Table 16-34. Evaluation of Functional Factors of Alternatives, Lompoc Valley Region

Service area/Factor	No Action	Alternative I: Ocean Disposal	Alternative I: Stream Disposal	Alternative I: Spray Irrigation with Storage	Alternative II: Ocean Disposal	Alternative II: Stream Disposal	Alternative II: Spray Irrigation with Storage
Vandenberg Air Force Base							
Effectiveness	Poor	Excellent	Marginal	Adequate	Excellent	Marginal	Adequate
Reliability	Poor	Excellent	Adequate	Excellent	Excellent	Adequate	Excellent
Flexibility	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Implementation	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Reclamation Potential	Marginal	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Compatibility	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Overall Rating	Poor	Excellent	Adequate	Adequate	Excellent	Adequate	Adequate
Federal Correctional Institution							
Effectiveness	Poor	NA[a]	Excellent	NA	NA	Adequate	Adequate
Reliability	Poor	NA	Adequate	NA	NA	Adequate	Adequate
Flexibility	Marginal	NA	Adequate	NA	NA	Adequate	Adequate
Implementation	Poor	NA	Adequate	NA	NA	Marginal	Adequate
Reclamation Potential	Marginal	NA	Excellent	NA	NA	Adequate	Adequate
Compatibility	Poor	NA	Excellent	NA	NA	Poor	Poor
Overall Rating	Poor	NA	Excellent	NA	NA	Adequate	Adequate
City of Lompoc							
Effectiveness	Poor	NA	Excellent	NA	NA	Excellent	NA
Reliability	Poor	NA	Excellent	NA	NA	Excellent	NA
Flexibility	Marginal	NA	Excellent	NA	NA	Excellent	NA
Implementation	Poor	NA	Adequate	NA	NA	Adequate	NA
Reclamation Potential	Marginal	NA	Excellent	NA	NA	Excellent	NA
Compatibility	Poor	NA	Excellent	NA	NA	Excellent	NA
Overall Rating	Poor	NA	Excellent	NA	NA	Excellent	NA
Vandenberg Disposal Company							
Effectiveness	Poor	NA	Excellent	NA	NA	Excellent	NA
Reliability	Poor	NA	Excellent	NA	NA	Excellent	NA
Flexibility	Marginal	NA	Excellent	NA	NA	Excellent	NA
Implementation	Poor	NA	Adequate	NA	NA	Adequate	NA
Reclamation Potential	Marginal	NA	Excellent	NA	NA	Excellent	NA
Compatibility	Poor	NA	Excellent	NA	NA	Excellent	NA
Overall Rating	Poor	NA	Excellent	NA	NA	Excellent	NA
Lompoc Utility Services							
Effectiveness	Poor	NA	Excellent	NA	NA	Excellent	NA
Reliability	Poor	NA	Excellent	NA	NA	Excellent	NA
Flexibility	Marginal	NA	Excellent	NA	NA	Excellent	NA
Implementation	Poor	NA	Adequate	NA	NA	Adequate	NA
Reclamation Potential	Marginal	NA	Excellent	NA	NA	Excellent	NA
Compatibility	Poor	NA	Excellent	NA	NA	Excellent	NA
Overall Rating	Poor	NA	Excellent	NA	NA	Excellent	NA

[a]Not applicable.

are drained from the service area by a separate sewerage system.

Portions of the wastewater treatment plant now in service were constructed in 1959 when the community's sewers were installed. The capacity of the plant was increased in 1971 to 0.3 mgd. Wastewater entering the plant first passes through a barminutor, or if the barminutor is inoperable, through a bar screen. Downstream, a Parshall flume and meter continuously record the flow rate through the plant. The wastewater then enters a pre-aeration holding basin equipped with floating aerators. By using either one or both of the aerators and by controlling the flow from the basin, it can be used to regulate the flow rate and strength of wastewater influent to the remaining portion of the plant. The irregular flow and wide variation in wastewater strength due to the commercial establishments in the community can thus be controlled and a uniform flow properly treated in the original extended aeration plant.

Effluent from the aerated holding basin flows through another barminutor and into two-150,000 gallon aeration tanks. Two blowers deliver air to the incoming wastewater. Aerated wastewater and activated sludge flows to two sedimentation tanks. Activated sludge is separated from the wastewater and returned to the headworks of the plant downstream of the Parshall flume. It is also possible to waste settled sludge to two sludge drying beds during extended periods of peak loading.

Facilities existing in 1969 were not damaged by the floodwaters caused by the January 25 storm. The crests of all the percolation ponds were constructed two feet higher than the high water mark of the 1969 flood and dike crest widths are 20 feet. The plant itself is constructed 6 to 8 feet above the 1969 high water mark. The plant has no emergency generating equipment and it is not possible to bypass wastewater to the Santa Ynez River.

Treated wastewater is discharged to four evaporation percolation ponds with a total area of about 4.6 acres. The ponds have continuous high banks and do not allow the effluent to be discharged directly to the adjacent Santa Ynez River.

The existing plant has certain deficiencies which should be corrected. These deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the aerated holding basin. Because of this, grit settles out in the basin, reducing its capacity.

2. No facilities are available to either aerobically or anaerobically digest the excess sludge wasted from the process during periods of peak loadings.

3. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality during the tourist season, although the holding basin does provide some storage.

4. An auxiliary power supply is not available.

The Buellton Community Services District WTP is required to meet discharge requirements promulgated by the Regional Board in 1972. The concentration of TDS, chloride, and sodium in the plant effluent presently exceed the incremental limits set by the Regional Board. The District has recently proposed a source control program which is designed to result in compliance with their discharge requirements.

Solvang Municipal Improvement District

The Solvang Municipal Improvement District (SMID) comprises approximately 1,375 acres in the Upper Santa Ynez River Valley situated 25 miles northwest of the City of Santa Barbara. The District was organized under a Special Act of the State Legislature known as the "Solvang Municipal Improvement District Act" which became effective on July 23, 1951. SMID provides public services including sewerage to the community of Solvang.

The existing land use within the District is primarily residential, inter-mixed with commercial and public lands and minor areas of dry-type industrial use. A substantial influx of tourists has a major effect on wastewater flows. Significant numbers of tourists visit Solvang daily with an exceptionally large influx during holidays, summer weekends and annual community festivals. As many as 50,000 visitors have attended "Danish Days", a three-day festival occurring annually in September.

The SMID sewerage collection system serves both sides of the Santa Ynez River with a 15-inch interceptor sewer transferring all wastewaters from the northern portion of the service area to the treatment plant south of the river. The collection network is comprised of gravity sewers ranging in diameter from 6 to 15 inches. The design capacity of the main 15-inch interceptor is 1.6 mgd. Stormwaters are drained from the service area by a separate system.

The SMID wastewater treatment plant provides secondary treatment by means of the extended aeration activated sludge process and has an ADWF capacity of 0.3 mgd. Wastewater is pumped into the plant and passes through a bar screen and a comminuting device.

Carbonaceous oxidation occurs in an aeration basin which is 90 feet in length, 30 feet in width and 15 feet in depth. Mixed liquor then flows to two of three existing secondary clarifiers. Settled activated sludge is returned to the aeration tank. Waste activated sludge from the extended aeration process is periodically pumped from the sedimentation tanks and hauled by truck to spreading area on the Gardner Ranch adjacent to the plant.

Effluent is discharged to percolation-evaporation basins in the flood plain of the Santa Ynez River. A portion of the effluent is periodically reused for agricultural irrigation on the Gardner Ranch west of the treatment facility.

The Solvang Municipal Improvement District WTP is required to meet discharge requirements promulgated by the Regional Board in 1972. The concentrations of TDS, chloride and sodium in the plant effluent presently exceed the incremental limits set by the Regional Board. The District has adopted a source control program which is designed to result in compliance with its discharge requirements.

Cachuma County Sanitation District

The Cachuma County Sanitation District provides sewerage service to the Cachuma Recreation Area. The Cachuma Recreation Area surrounds Lake Cachuma, a multi-purpose reservoir in the upper Santa Ynez River Sub-basin. During the summer of 1972, the average daily attendance at the recreational area was about 4,400 persons.

Wastewaters collected by gravity from the church camp in 4-, 6- and 8-inch vitrified clay pipe flows to one of the system pumping stations. The pumping station forces the wastewater through a 6-inch force main which empties into an 8-inch trunk sewer. A second pumping station pumps wastewaters collected in the recreational area proper to a third pumping station which forces the wastewater through a 6-inch force main which empties into an 8- and 12-inch gravity sewer tributary to the treatment plant.

The Cachuma WTP is designed to provide secondary treatment by means of the extended aeration activated sludge process to an ADWF of 0.22 mgd. Influent passes through a comminuting device and into two aeration tanks. A bypass bar screen is available. The aeration tanks are 40 feet in length, 25 feet in width and 13.5 feet in depth. Air is diffused into a high concentration of suspended activated sludge in the aeration tanks and carbonaceous oxidation takes place. Activated sludge is separated from the treated wastewater in two secondary sedimentation tanks. The tanks are 40 feet in length, 6 feet in width and 9.5 feet deep. Clarified secondary effluent is chlorinated and flows through a chlorine contact chamber which is 15 feet long, 12 feet wide and 8 feet deep and which contains 3 baffles along its length. Chlorinated effluent is discharged to a series of two oxidation ponds with a total surface area of about 2 acres and a water depth of about four feet. Oxidation pond effluent is used to spray irrigate an area adjacent to the plant.

The Cachuma County Sanitation District collection system is relatively new and reportedly allows a nominal amount of stormwater inflow.

The existing plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the aeration tanks. Because of this, grit settles out in the aeration tanks, reducing their capacity.

2. No facilities are available to either aerobically or anaerobically digest the excess sludge wasted from the process during periods of peak loading.

3. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality during the tourist season.

The Cachuma County Sanitation District WTP is required to meet discharge requirements promulgated by the Regional Board in 1972. The District is in compliance with those requirements. Duplicate pumping units and an auxiliary power supply are available to preclude accidental discharges of raw wastewater to the reservoir.

Alternative Municipal Wastewater Management Plans — Upper Santa Ynez Region

Alternative plans involving degrees of consolidation of treatment and disposal functions, land disposal by percolation, and whether or not to sewer certain communities have been investigated. Utilizing the assessment of environmental sensitivity discussed earlier, three basic alternative plans, each of which contains several sub-alternatives, and a no action alternative were developed: Alternative I consists of consolidation of treatment and disposal for the communities of Buellton, Solvang and Santa Ynez at the Buellton Community Services District WTP; Alternative II consists of consolidation of treatment and disposal for the communities of Santa Ynez and Solvang at the Solvang Municipal Improvement District WTP; and Alternative III consists of enlarging and upgrading the existing treatment and disposal facilities and either sewering Santa Ynez or allowing it to remain unsewered.

No Action Alternative. The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing system noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the area could be stopped, or significantly curtailed, and the current means of wastewater management, with its deficiencies, continued.

Alternative I. Alternative I envisions the sewering of Santa Ynez and the conveyance of untreated wastewaters from Santa Ynez and Solvang to a regional WTP at Buellton. The existing WTP at Solvang will be abandoned. After treatment, wastewaters will be disposed of by percolation. Because such discharges have not caused nitrate impairment of groundwaters in the past, it is assumed that biological secondary treatment with disinfection will be required for discharge to percolation basins. With this disposal option, monitoring of the quality of local groundwaters will be necessary. If significant nitrate buildup does occur, nitrogen removal may be necessary at some time in the future. The Cachuma County Sanitation District (CSD) WTP would be enlarged and upgraded with disposal by percolation at a site out of the watershed of Lake Cachuma. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-13. The estimated project costs of the facilities required for this alternative are given in Table 16-35.

Alternative II. Alternative II consists of sewering of Santa Ynez and conveyance of the untreated wastewaters to an upgraded and enlarged WTP at Solvang. Disposal would be by percolation. The existing WTP at Buellton would be upgraded and enlarged with disposal by percolation. For Cachuma CSD, alternatives I and II are the same. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-13. The estimated project costs of the facilities required for this alternative are given in Table 16-35.

Alternative III. Alternative III calls for upgrading and enlarging the existing treatment and disposal facilities at the Buellton CSD, the Solvang MID and the Cachuma CSD with disposal by percolation. The community of Santa Ynez would either be sewered and treat its wastewaters at a separate WTP with disposal as above or the community would remain unsewered and its population density would be limited. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-13. The estimated project costs of the facilities required for this alternative are given in Table 16-35.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to export the combined wastewater flow out of the sub-basin, stream disposal, etc.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. Although it is beyond the scope of this report to investigate in detail plans for wastewater reclamation and reuse, it is appropriate to discuss the wastewater reuse potential in the study area. The detailed feasibility of each reuse for which significant potential is apparent should be investigated during project level planning. If such investigations indicate that a certain wastewater reuse is feasible, it should be implemented as a part of the basin water quality control plan.

Fig. 16-13 Alternative Municipal Wastewater Management Plans
Santa Ynez River Subbasin
Upper Santa Ynez Region

Table 16-35. Evaluation of Economic Factors of Alternatives, Upper Santa Ynez Region, Thousands of Dollars[a]

	Alternative I	Alternative II	Alternative III
Factor/service area	Percolation	Percolation	Percolation
Capital costs[b]			
Buellton Community Services District	600	700	700
Solvang Municipal Improvement District	2,300	600	600
Santa Ynez Community Services District	2,900	2,300	1,800
Cachuma County Sanitation District	300	300	300
Total	6,100	3,900	3,400
Total annual costs			
Buellton Community Services District	100	130	130
Solvang Municipal Improvement District	220	120	130
Santa Ynez Community Services District	300	190	170
Cachuma County Sanitation District	80	80	80
Total	700	520	510
Present worth			
Buellton Community Services District	1,100	1,500	1,500
Solvang Municipal Improvement District	2,600	700	1,400
Santa Ynez Community Services District	2,300	2,800	2,000
Cachuma County Sanitation District	900	900	900
Total	6,900	5,900	5,800
Initial local annual financial burden			
Buellton Community Services District	40	60	60
Solvang Municipal Improvement District	70	60	70
Santa Ynez Community Services District	60	50	60
Cachuma County Sanitation District	40	40	40
Total	210	210	230

[a] Costs based on ENR construction cost index of 2000.

[b] Costs of staged construction of facilities required to meet projected wastewater demands until the year 2000.

Possible uses for reclaimed water include agriculture, recreation and land beautification, industry, domestic use, streamflow augmentation and groundwater recharge. Within the study area, those reuse options which exhibit apparent potential and which should be investigated further at the project level include agriculture, freeway and park landscape irrigation and groundwater recharge.

Comparison of Alternatives – Upper Santa Ynez Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics of the alternatives is accomplished and the recommended plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-35.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

The capital cost of alternative III is about 15 percent less than alternative II and about 45 percent less than alternative I. The total annual costs of alternatives II and III, however, are essentially the same due to the economy of scale which could be realized by conveying wastewater from the Santa Ynez Community Services District to the Solvang Municipal Improvement District WTP. Moreover the initial local annual financial burden of alternative II is much less than alternative II because the consolidation alternative is capital cost intensive and much of the capital cost will be grant eligible.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-36.

In general alternative II is rated higher than alternatives I and III and much higher than the No Action Alternative. The analysis of functional factors indicates that conveyance of all wastewaters to the Buellton CSD WTP would not allow wastewater reuse in the Solvang area, where a definite potential exists and where reuse for agricultural irrigation is presently occurring. The analysis favors the conveyance of wastewater from Santa Ynez to the Solvang MID WTP mainly because such a consolidation would prevent the creation of another very small wastewater treatment plant. Very small wastewater treatment plants are expensive to operate and usually lack the reliability of larger operations.

SANTA BARBARA COASTAL SUB-BASIN

The Santa Barbara Coastal Sub-basin comprises that portion of Santa Barbara County which lies south of the Santa Ynez Mountains. The sub-basin is drained by many southward-flowing streams which discharge to the Pacific Ocean. The eastern half of the sub-basin has been intensely developed and urban and suburban land uses predominate. There are presently five discharges of municipal wastewater in the sub-basin: the Goleta Sanitary District, the City of Santa Barbara, the Montecito Sanitary District, the Summerland Sanitary District, and the Carpinteria Sanitary District.

Goleta Sanitary District

The Goleta Sanitary District encompasses an area of about 4,800 acres, bounded on the east by the City of Santa Barbara, on the west by the La Patera Road area and extends from the edge of the Santa Ynez mountains to the Pacific Ocean. Treatment and disposal is provided by the District for wastewaters collected in the Isla Vista Sanitary District, the University of California, Santa Barbara campus, the Santa Barbara Municipal Airport area, and a small portion of the west end of the City of Santa Barbara. These areas comprise an additional 12,800 acres and the individual agencies own capacity rights in and contribute wastewater to the Goleta Sanitary District WTP.

The District's initial construction of the wastewater collection system began in 1950. In 1957 the system was expanded to include the Struck area and in 1965 it was expanded to its present configuration. Main trunk sewers were installed at that time to provide a capacity of 10 mgd and 5,800-foot ocean outfall was constructed.

Table 16-36. Evaluation of Functional Factors of Alternatives, Upper Santa Ynez Region

Service area/factor	No action	Alternative I Percolation	Alternative II Percolation	Alternative III Percolation
Buellton Community Services District				
Effectiveness	Poor	Excellent	Excellent	Excellent
Reliability	Poor	Adequate	Adequate	Adequate
Flexibility	Marginal	Adequate	Excellent	Excellent
Implementation	Poor	Marginal	Excellent	Excellent
Reclamation potential	Marginal	Excellent	Excellent	Excellent
Compatibility	Poor	Adequate	Excellent	Excellent
Overall rating	Poor	Adequate	Excellent	Excellent
Solvang Municipal Improvement District				
Effectiveness	Poor	Marginal	Excellent	Excellent
Reliability	Poor	Adequate	Adequate	Adequate
Flexibility	Marginal	Poor	Excellent	Excellent
Implementation	Poor	Marginal	Excellent	Excellent
Reclamation potential	Marginal	Poor	Excellent	Excellent
Compatibility	Poor	Adequate	Excellent	Excellent
Overall rating	Poor	Marginal	Excellent	Excellent
Santa Ynez Community Services District				
Effectiveness	Poor	Marginal	Excellent	Excellent
Reliability	Poor	Adequate	Excellent	Marginal
Flexibility	Marginal	Poor	Adequate	Adequate
Implementation	Poor	Marginal	Adequate	Adequate
Reclamation potential	Marginal	Poor	Excellent	Adequate
Compatibility	Poor	Adequate	Excellent	Poor
Overall rating	Poor	Marginal	Excellent	Adequate
Cachuma County Sanitation District				
Effectiveness	Poor	Excellent	Excellent	Excellent
Reliability	Poor	Adequate	Adequate	Adequate
Flexibility	Marginal	Excellent	Excellent	Excellent
Implementation	Poor	Excellent	Excellent	Excellent
Reclamation potential	Marginal	Excellent	Excellent	Excellent
Compatibility	Poor	Adequate	Adequate	Adequate
Overall rating	Poor	Excellent	Excellent	Excellent

The wastewaters emanating from the Santa Barbara Municipal Airport and from the University of California campus are conveyed to the WTP in two separate 12-inch force mains. The Isla Vista Sanitary District utilizes an 18-inch force main to convey its wastewater to the WTP. A 36-inch gravity sewer from the Goleta Sanitary District directs the District's flow to a comminuting device and then to a lift station at the WTP.

The lift station and the three force mains discharge to the headworks of the wastewater treatment plant. The flow in each line is metered and continuously recorded. The Goleta Sanitary District WTP is designed to provide primary sedimentation treatment to an ADWF of 14 mgd.

Wastewaters enter two comminuting devices operated in parallel. Each comminutor discharges into an aerated grit chamber. Wastewater then flows to five primary clarifiers. The plant contains a 130-foot diameter biofilter with a rock media depth of 6 feet which is presently not in use. Major revisions in piping would be required to use the biofilter and also a secondary clarifier would have to be constructed.

Facilities are available to chlorinate the primary effluent prior to its discharge to the District's ocean outfall. Presently, there is no chlorine contact chamber. Chlorine residual can be measured and recorded by two residual analyzers.

Settled primary sludge and scum are pumped by four sludge pumps to two anaerobic digesters operated in series. The primary digester is equipped with a gas recirculation system. The digesters are heated by circulating sludge through one of three heat exchangers. Supernatant is removed from the secondary digester and discharged to the influent lift station. Digested sludge is dried on sludge drying beds which are also drained to the influent lift station.

Plant effluent is discharged at a depth of 92 feet into the Pacific Ocean through a 36-inch ocean outfall which extends 5,800 feet into Goleta Bay. The final 270 feet of the outfall is provided with thirty-four 4-inch ports, spaced at 8 feet on center on each side of the outfall pipe. It was calculated that with all the ports open, that the gravity hydraulic capacity of the outfall would be 24 mgd.

Because the flow from each of the collection systems is metered separately, it would be possible to determine the amount of stormwater inflow into each system if the Santa Barbara Airport and the University of California had variable speed pumping. Storm inflow contributes about 590 gad to the Isla Vista Sanitary District system and 1,330 gad to the Goleta Sanitary District system. Although it is not possible to quantify the inflow problem for the Airport and University, the average flow from the Airport and University systems does increase significantly during wet weather, indicating that a significant amount of inflow does occur.

The treatment plant has certain deficiencies which require correction, including the following:

1. Insufficient comminuting and grit removal capacity is available and that which is available allows very little flexibility in its operation.

2. An alternate power supply is not available.

3. In general, the plant has several features which do not comply with the National Occupational Health and Safety Act. Abandoned process units present serious safety hazards.

4. The structural integrity of one of the plant's anaerobic digesters should be investigated.

5. The proximity of the plant to a planned future airport terminal could result in odor control problems.

The Goleta Sanitary District ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State's Ocean Plan. Computer simulation of the performance of the outfall indicates that the discharge will meet the 100 to 1 initial dilution required by the State's Ocean Plan. At the existing ADWF and with all of the diffuser ports open, the outfall provides an initial dilution of 170 to 1 in summer.

A Technical Report on its ocean discharge submitted by the District in January, 1973, indicated that the concentrations of settleable solids, toxicity, total identifiable chlorinated hydrocarbons, and several heavy metals exceed the limits set by the State's Ocean Plan. The District has proposed the implementation of an influent monitoring and source control program and the investigation of the treatment plant modifications necessary to insure compliance with the Plan.

City of Santa Barbara

The City of Santa Barbara provides wastewater collection, treatment and disposal services for essentially the entire area within the city's boundaries. In 1971, the City of Santa Barbara system served a population of about 71,000 and the service area comprised about 10,300 acres. The ADWF in 1971 was 8.0 mgd.

The City's existing wastewater collection system consists of about 250 miles of vitrified clay pipe ranging in size from 6 to 42 inches. Wastewater is presently transported to the Santa Barbara STP by two main interceptor sewers; a 42-inch reinforced concrete line constructed in 1951 connecting the plant to the abandoned screening plant adjacent to the beach and an 18-inch vitrified clay pipe constructed in 1957 to convey flow from the southeastern portion of the city to the plant.

The City of Santa Barbara WTP is designed to provide conventional primary treatment (sedimentation) to an ADWF of 7.5 mgd. The plant was originally constructed in 1951 and has been modified subsequently.

Influent wastewater from the 18 and 24-inch influent sewers passes through a 36-inch wide communition device or through a bypass channel equipped with a manually cleaned bar rack. Comminuted wastewater enters the wet well of the influent pumping station and is pumped to the plant's two primary clarifiers. Primary effluent passes through a Parshall flume and is chlorinated prior to being discharged to the city's ocean outfall.

Two sludge and scum pumps, convey sludge and scum from the clarifiers to the primary digester. Two anaerobic digesters, 65 feet in diameter are operated in series as primary and secondary digesters. Supernatant can be removed from the secondary digester and returned to the headworks of the plant. Sludge is withdrawn from the secondary digester and is either placed on drying beds or is centrifuged. A 75 horsepower diesel engine provides standby power to the influent pumping station. The unit provides only enough power to operate the single 5,000 gpm pump in case of a power failure.

Effluent is currently discharged to the Santa Barbara Channel through a 42-inch diameter reinforced concrete submarine outfall. Constructed in 1945, this outfall consists of a 1,300 foot long land section and a 3,400 foot submarine section discharging effluent at a depth of 42 feet through a 299 foot corrugated metal diffuser section. Under the most adverse tidal conditions, the reported capacity of the existing submarine outfall, flowing under gravity conditions, is 20.4 mgd.

An anlysis of wet weather infiltration and direct storm inflow to the City's collection system indicate that up to 1,820 to 2,740 gad occurs. This amount of storm inflow is not consistent with modern sewer design and good construction practices.

The recent discovery and removal of a connection to a storm drainage channel adjacent to the plant has decreased peak wet weather flows. The City has also initiated a program of replacing leaking manhole covers and of grouting lines suspected of allowing excessive infiltration.

The treatment plant has certain deficiencies which require correction. Those deficiencies can be summarized as follows:

1. The hydraulic capacities of the influent screening facilities and pumping station, and of the Parshall flume and clarifiers are insufficient for peak wet weather flows.

2. Constant speed influent pumps lower the efficiency of the treatment process.

3. The screening facilities are located within the influent pumping station wet well which makes maintenance difficult.

4. There are no grit removal facilities.

5. The mechanical equipment and piping in the vicinity of the clarifiers should be replaced.

6. Considerable deterioration of the concrete effluent boxes on the clarifiers has occurred.

7. The structural integrity of the roofs of the digesters is questionable.

8. The existing chlorination capacity and chlorination mechanical equipment are inadequate.

9. Insufficient standby power is available.

10. The laboratory, office and maintenance areas are inadequate.

The City has proposed to correct the above deficiencies. The improved Santa Barbara WTP will consist of comminution, grit removal, primary sedimentation, aeration, secondary sedimentation, and effluent chlorination. Sludge will be thickened, anaerobically digested, dewatered with vacuum filters and used locally as a soil conditioner and fertilizer. Excess solids will be hauled to a suitable landfill site.

The new plant will be designed with an ADWF capacity of 11 mgd and a peak hydraulic capacity of 22 mgd. A standby power generator will be included in the plant. Emergency bypasses will include a minimum of screening, grit removal, sedimentation and disinfection.

Annual inspections of the existing ocean outfall by divers have indicated that its structural integrity is questionable. The divers have reported that the concrete pipe has undergone considerable spalling and that the reinforcing steel is exposed at several locations. The City has proposed to construct a new ocean outfall.

The City of Santa Barbara WTP ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State's Ocean Plan. Presently the City's discharge is not in compliance with those requirements. Upon completion of the improvements mentioned above and upon the implementation of an effective source control program, the discharge is anticipated to be in compliance with the Plan.

Montecito Sanitary District

The service area of the Montecito Sanitary District extends about 2.5 miles in an easterly direction from the City of Santa Barbara along the coast and 2.5 miles inland and encompasses about 5,500 acres.

Formed in 1947 under provisions of the Sanitary District Act of 1923, the Montecito Sanitary District now provides service to an area of approximately 3,200 acres, about 58 percent of the area within district boundaries. In 1971 about 4,600 persons were served by the system. The ADWF from the service area was 0.75 mgd. The service area slopes gently toward the Pacific Ocean thereby allowing the majority of the wastewaters to be collected and transported to the Montecito WTP by gravity. The sewerage system consists of trunk sewers that serve the three principal basins which are drained by Montecito, Oak and Romero Creeks. These sewers range in diameter from 8 to 21 inches and include two 2,100-foot force mains 6 inches in diameter charged by the Posilipo pumping station. Two inverted siphons are located on the main 18-inch line allow crossing of both Montecito Creek and a large storm drain east of the creek. The siphon at each crossing has two barrels, 10 and 12-inch in diameter, with a combined capacity equivalent to that of the main line.

Pumping facilities for the Montecito wastewater collection system consist of six lift stations, two of which are ejectors. Constant speed drives provide the necessary power for each pumping unit. The capacities of the lift stations vary from 0.07 to 0.43 mgd.

The Montecito WTP provides secondary treatment by means of the extended aeration modification of the activated sludge process and has current average dry weather flow (ADWF) capacity of 0.75 mgd. Influent wastewater is comminuted through an 18-inch barminutor and pumped to two aeration tanks by two variable speed pumps. The wastewater is aerated for about 26 hours in two tanks. Two rotary displacement blowers provide the necessary air supply to maintain dissolved oxygen levels in the aeration tank above 1 mg/l.

Following the aeration, flow continues through the plant by gravity to two secondary sedimentation tanks. The tanks provide a detention time of 4.3 hours and have a surface overflow rate of 390 gpm at the plant's design ADWF capacity. Settled activated sludge is returned to the aeration tanks and waste activated sludge is transferred to drying beds. After drying, the sludge is removed from the beds and transported to landfills. The drainage from the sludge drying beds is returned to the influent lift station wet well for treatment in the plant.

Secondary effluent is chlorinated and flows through a chlorine contact tank. Chlorine solution is fed from the chlorinator through plastic pipes to the chlorine contact tank where it is in contact with the treated wastewater for an average of 30 minutes prior to being discharged to the ocean outfall.

Treated effluent is discharged to the land portion of the District's ocean outfall. The land portion begins at the WPCF effluent flow metering station and consists of 1,850 feet of 18-inch asbestos cement pipe which joins the ocean outfall section at the ocean shoreline approximately 1,800 feet west of the Biltmore Hotel Pier in Montecito. The ocean outfall section consists of approximately 1,550 feet of 18-inch cast iron pipe extending to a depth of 35 feet below mean sea level. The last 90 feet of the outfall are provided with 10 diffuser ports, each 4 inches in diameter. The diffuser openings are alternately spaced at 9-foot centers on each side of the pipe to disperse the effluent uniformly into the ocean. At the present, the diffuser has five ports open and provides a minimum initial dilution of approximately 60 to 1. The gravity flow hydraulic capacity of the effluent outfall system is 5.1 mgd with all ten diffuser ports open and without surcharging, and may be increased to 6.4 mgd by providing pressure manholes.

The existing treatment plant is now operating at its design capacity of 0.75 mgd. In addition, the plant has certain deficiencies which should be corrected. Those deficiencies can be summarized as follows:

1. An auxiliary power source is not available.

2. Grit removal facilities are not available and as a result grit settles in the aeration tanks reducing their capacity.

3. Sufficient duplicate process units are not available to allow individual units to be bypassed and repaired while maintaining effluent quality.

4. Facilities for aerobic or anaerobic digestion of excess activated sludge are not available.

The District has proposed that the plant be upgraded and enlarged and that the outfall be modified to obtain higher initial dilution.

Summerland Sanitary District

The Summerland Sanitary District System serves the unincorporated community of Summerland, located between the City of Santa Barbara and Carpinteria. Existing development of the 530 acres within the District is predominantly residential. In 1972 there were two restaurants and a jewelry manufacturing plant connected to the system. The system serves a population of 1,200. The ADWF in 1972 was about 0.06 mgd.

The collection system, constructed in 1960-61, consists of approximately 4.4 miles of vitrified clay sewer pipe ranging in size from 6 to 12 inches in diameter. The system conveys wastewater to the Summerland Wastewater Treatment Plant entirely by gravity. Stormwaters are drained by a separate system.

The Summerland Sanitary District WTP is designed to provide secondary treatment for wastewater flows up to 0.15 mgd. The facility consists of a comminutor, a primary clarifier, two combination aerator clarifiers, an anaerobic sludge digester, a sludge drying bed, a rapid sand filter, a chlorinator, and a chlorine contact tank.

Treated plant effluent is disposed of in the Pacific Ocean through a 12-inch cast iron ocean outfall. The outfall terminates about 740 feet from shore in an 8-foot long tee and discharges the effluent vertically through two 2-foot long, 12-inch diameter pipes into about 19 feet of water (MSL).

Insufficient data were available to allow an analysis of wet weather infiltration and direct storm inflow to the District's collection system. Such data should be collected and an inflow analysis performed.

The treatment plant has certain deficiencies which require correction. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the primary sedimentation tank. Because of this, grit settles out in the digester, reducing its capacity.

2. Sufficient duplicate process units are not available to allow malfunctioning units to be bypassed and repaired while maintaining effluent quality. Primary sedimentation anerobic digestion and effluent filtration occur in single units.

3. An auxiliary power supply is not available.

4. The design of the activated sludge process units does not allow the operator sufficient flexibility to maintain optimum performance.

5. The treatment plant has only one operator and is thus unattended a significant portion of the time.

The Summerland Sanitary District WTP ocean discharge will have to meet the receiving water and effluent quality requirements stipulated in the State Ocean Plan. Computer simulation of the performance of the District's ocean outfall indicates that at the present ADWF, during the summer wastewaters experience an initial dilution of less than 11 to 1 with sea water. This is much less than the 100 to 1 initial dilution required by the State Ocean Plan. In the Technical Report on its ocean discharge required by the State's Ocean Plan, the District noted that present concentrations of total chromium and grease and oil exceed the limits set in the State's Ocean Plan. The District proposes to control these constituents at their sources.

Carpinteria Sanitary District

The Carpinteria Sanitary District provides sewerage service to a population of about 10,000 and is situated between the Santa Ynez Mountains and the Pacific Ocean at the eastern edge of Santa Barbara County. The total developable area within the ultimate area of service is approximately 12 square miles. Land use is predominantly agricultural and residential with some industrial and commercial development.

The District's wastewater collection system consists of about 124,000 lineal feet of gravity sewer, 3,000 feet of force main and three lift stations. A separate system for storm drainage has been provided. A fourth lift station and 3,800 lineal feet of force main were under construction in 1972. The existing gravity sewers range in size from 6 to 21 inches and consists of vitrified clay and cast iron pipe. The existing force mains are constructed of 6, 8 and 12-inch cast iron pipe. A portion of the collection system serving the City of Carpinteria was constructed in the 1930's and is thought to allow excessive infiltration. The present average daily dry weather flow conveyed to the treatment plant is about 1.3 mgd. Stormwaters are drained from the service area by a separate system.

The Carpinteria WTP consists of two separate biofiltration plants which can be operated separately or as a single unit. At the present time the two plants are being operated separately, in parallel.

The original plant, which was constructed in 1952 and which has a nominal design ADWF capacity of 0.5 mgd, consists of primary and secondary clarifiers, a biofilter and a sludge digester. In 1962 a new plant with a nominal design capacity of 1.5 mgd was constructed which consists of primary and secondary clarifiers, a biofilter, a spirovortex mixing system and an anaerobic sludge digester.

Digested sludge is placed on sludge drying beds. According to the District, drainage from the beds is piped to the surge chamber upstream of the ocean outfall. Dried sludge is used by local ranchers as a soil conditioner and fertilizer.

In 1962 the District constructed its present ocean outfall. The outfall consists of 24-inch diameter welded steel pipe with a one-half inch thick concrete interior lining and a 2-inch thick concrete exterior coating. The outfall is 1,600 feet long from the surge chamber to its terminus which is approximately 1,000 feet from shore in 30 feet of water (MSL). The calculated gravity flow capacity of the outfall is 7.0 mgd.

Insufficient data were available to conduct an analysis of wet weather infiltration and direct storm inflow to the District's collection system. Such an analysis should be accomplished.

The treatment plant has certain deficiencies which require correction. Those deficiencies can be summarized as follows:

1. There are no facilities to remove grit prior to the introduction of the raw wastewater to the primary sedimentation tanks. Because of this, grit settles out in the digesters, reducing their capacity.

2. An auxiliary power supply is not available.

3. The sludge drying beds drain to the ocean outfall surge chamber.

4. Effluent from the original plant bypasses the chlorine contact chamber. Chlorine contact occurs in the ocean outfall.

Alternative Municipal Wastewater Management Plans — Santa Barbara Coastal Sub-Basin

Alternative plans involving degrees of consolidation of treatment and disposal functions, ocean disposal, land disposal by spray irrigation and percolation and stream disposal have been investigated. Utilizing the assessment of environmental sensitivity, four basic alternative plans, each of which contains several sub-alternatives, and a no action alternative were developed: alternative I would consolidate treatment and disposal functions of four existing dischargers at an upgraded and enlarged City of Santa Barbara WTP with ocean disposal; alternative II would consolidate treatment and disposal function of three existing dischargers at the City of Santa Barbara WTP with ocean disposal; alternative III is similar to alternative II, except local treatment would be possible; alternative IV would consolidate treatment and disposal functions of two existing dischargers at an upgraded and enlarged Montecito Sanitary District WTP with ocean disposal;

Alternative V consists of upgrading the five existing wastewater treatment plants with either ocean, land or stream disposal. For the purposes of comparison of alternatives, it is assumed that both the City of Santa Barbara's currently proposed wastewater treatment and disposal project and the Montecito Sanitary District's currently proposed wastewater treatment and disposal project will have been completed by 1975. It is assumed that the nominal capacity of the City's new WTP will be about 11 mgd and Montecito's about 1.7 mgd.

No Action Alternative. The no action alternative consists of not upgrading or enlarging existing wastewater conveyance, treatment and disposal systems. With this option, the deficiencies of the existing systems noted in Chapter 6 would not be corrected. If flows to the existing systems are allowed to increase, overloaded conditions will develop, reliability and pollutant removal efficiency will decrease, and environmental impacts due to the discharge of partially treated or untreated wastewater will result. Alternatively, the growth of population and economic development of the areas could be stopped, or significantly curtailed, and the current means of wastewater management, with its deficiencies, continued.

Alternative I. Alternative I consists of the conveyance of untreated wastewaters from the Carpinteria Sanitary District, Summerland Sanitary District, and Montecito Sanitary District to an enlarged and upgraded City of Santa Barbara WTP. The existing wastewater treatment plants at Carpinteria, Summerland, and Montecito would be converted to pumping stations. Force mains would be constructed between Carpinteria and Summerland and between Summerland and Montecito. Montecito wastewater would be lifted to a gravity sewer which would convey the combined flow to the City of Santa Barbara WTP influent pumping station.

For ocean disposal, it is assumed that the city's currently proposed activated sludge WTP would be enlarged and dechlorination facilities provided. The construction of an effluent pumping station would be necessary to increase the capacity of the ocean outfall and modification of the outfall ports would be necessary to provide sufficient initial dilution.

Alternative I for the Isla Vista-Goleta area would consist of upgrading and enlarging the existing Goleta Sanitary District WTP with ocean disposal. For ocean disposal, two treatment methods are considered appropriate: primary sedimentation with chemical addition and biological secondary treatment; both treatment methods will require disinfection plus dechlorination. Either an effluent pumping station or a second, parallel ocean outfall with multiport diffusers will be needed to provide adequate outfall capacity for year 2000 peak wet weather flows. For this report, the construction of an effluent pumping station is assumed.

The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-14. The estimated project costs of the facilities required for this alternative are given in Table 16-37.

Alternative II. Alternative II consists of the conveyance of untreated wastewaters from Summerland Sanitary District and Montecito Sanitary District to an enlarged and upgraded City of Santa Barbara WTP with ocean disposal. The required levels of treatment are the same as in Alternative I. The Carpinteria Sanitary District WTP would be upgraded to provide the required treatment for ocean disposal. With ocean disposal, for planning purposes it is assumed that it will be necessary to extend the Carpinteria Sanitary District outfall to 1,000 feet beyond the 35-foot depth contour to construct a multiport diffuser and to provide an effluent pumping station to increase its capacity. For the Goleta-Isla Vista area, alternatives I and II are the same. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-14. The estimated project costs of the facilities required for this alternative are given in Table 16-37.

Alternative III. Alternative III is similar to alternative II in that capacity for solids treatment and disposal of wastewaters generated in the Summerland and Montecito Sanitary Districts would be provided in the Santa Barbara WTP and disposal facilities. The Montecito and Summerland WTP's would be upgraded and used as satellite wastewater reclamation plants. During seven months of the year, the two plants could be used to satisfy local demands for landscape irrigation water. The Montecito and Summerland ocean outfalls would be abandoned. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-14. The estimated project costs of the facilities required for this alternative are given in Table 16-37.

Table 16-37. Evaluation of Economic Factors of Alternatives, Santa Barbara Coastal Region, Thousands of Dollars[a]

Factor/service area	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative V			
	Ocean disposal	Ocean disposal	Ocean disposal	Ocean disposal	Ocean disposal	Stream disposal	Percolation	Spray irrigation
Capital cost[b]								
Goleta Sanitary District	8,000[c]	8,000[c]	8,000[c]	8,000[c]	8,000[c]	22,400	21,900	39,200
City of Santa Barbara	11,300	10,700	10,800	9,700	9,700	23,900	NA	34,900
Montecito Sanitary District	2,000	2,300	2,000	400	500	4,500	5,500	NA
Summerland Sanitary District	300	1,000	1,100	1,100	1,000	700	700	1,500
Carpinteria Sanitary District	5,900	2,900	2,900	2,900	2,900	3,900	4,200	15,000
Total	27,500	24,900	24,800	22,100	22,100	55,400	NA	NA
Total annual cost								
Goleta Sanitary District	1,280[c]	1,280[c]	1,280[c]	1,280[c]	1,280[c]	2,440	2,350	3,680
City of Santa Barbara	1,460	1,510	1,530	1,360	1,360	2,870	NA	4,220
Montecito Sanitary District	220	240	290	170	180	550	570	NA
Summerland Sanitary District	30	70	100	90	110	90	70	130
Carpinteria Sanitary District	540	410	410	410	410	560	530	1,210
Total	3,530	3,510	3,610	3,310	3,340	6,510	NA	NA
Present worth								
Goleta Sanitary District	13,600	13,600	13,600	13,600	13,600	26,100	25,300	36,100
City of Santa Barbara	16,300	16,300	16,500	14,800	14,800	33,600	NA	46,200
Montecito Sanitary District	2,500	2,800	3,400	2,100	2,100	6,600	7,100	NA
Summerland Sanitary District	300	900	1,300	1,300	1,300	1,100	900	1,500
Carpinteria Sanitary District	6,400	4,500	4,500	4,500	4,500	6,200	6,000	14,800
Total	39,100	38,100	39,300	36,900	36,200	73,600	NA	NA
Initial local annual financial burden								
Goleta Sanitary District	460	460	460	460	460	730	700	830
City of Santa Barbara	580	610	610	560	560	1,220	NA	1,500
Montecito Sanitary District	80	80	140	130	130	260	0	NA
Summerland Sanitary District	10	20	30	20	30	40	30	40
Carpinteria Sanitary District	140	170	170	170	170	220	200	350
Total	1,270	1,340	1,400	1,340	1,350	2,470	NA	NA

NA = not applicable

[a] Costs based on ENR construction cost index of 2000.

[b] Costs of staged construction of facilities required to meet projected wastewater demands until the year 2000.

[c] Wastewater treatment consists of primary sedimentation plus chemical addition with disinfection and dechlorination. Capital cost of biological secondary treatment would be $5,200,000 more; total annual cost would be about $420,000 more.

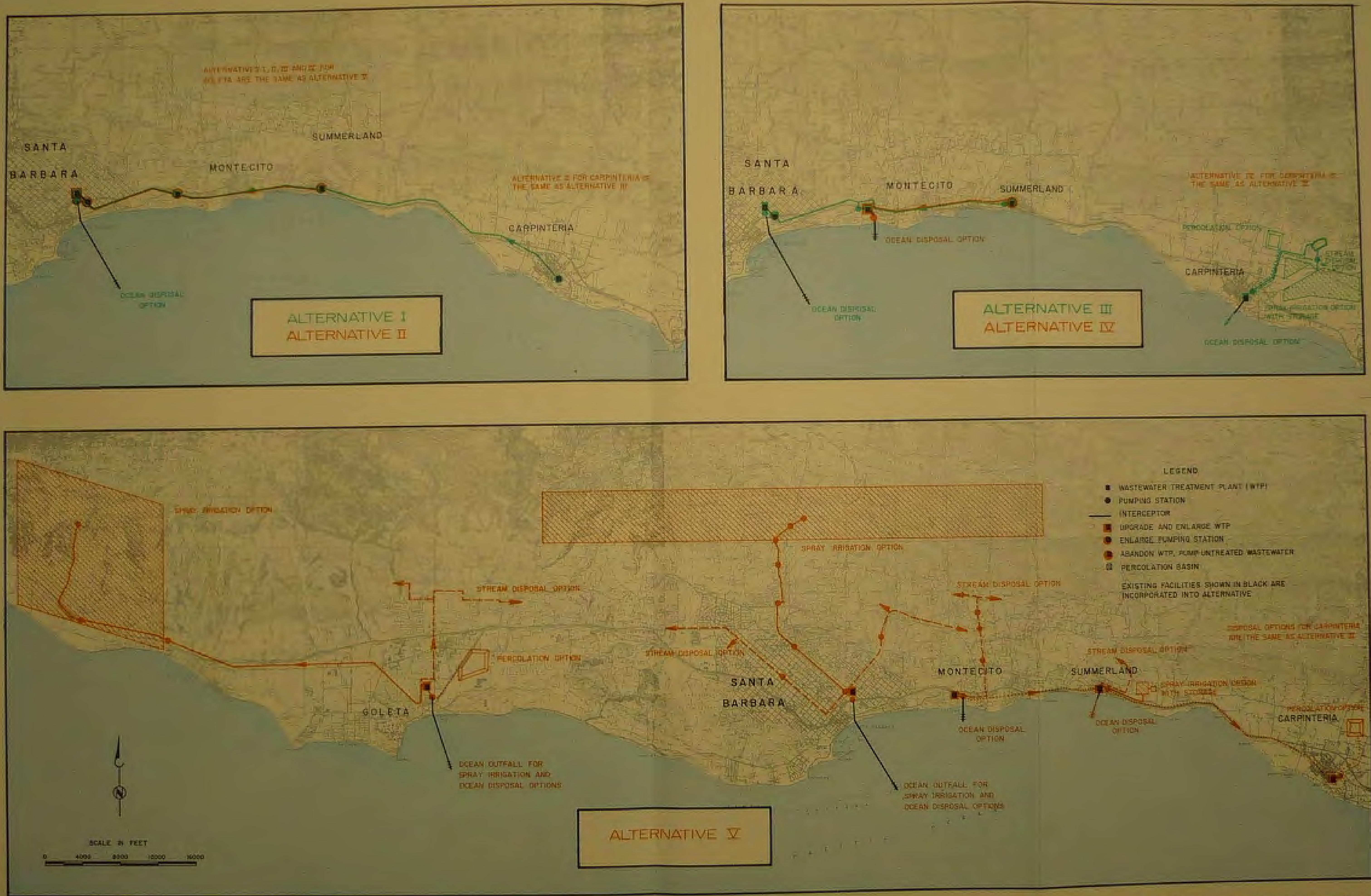


Fig. 16-14 Alternative Municipal Wastewater Management Plans Santa Barbara Coastal Subbasin

Alternative IV. Alternative IV includes the conveyance of untreated wastewaters from the Summerland Sanitary District to the enlarged and upgraded Montecito Sanitary District WTP. The existing WTP at Summerland would be converted to a pumping station. It is assumed that the currently proposed improvements to the Montecito Sanitation District WTP will be constructed by 1975. The nominal capacity of the enlarged plant will be 1.7 mgd. The plant's treatment processes would be enlarged and upgraded as necessary for ocean disposal.

For the Carpinteria Sanitary District and the Goleta Sanitary District, alternative plans II, III, and IV are the same. The City of Santa Barbara WTP would be enlarged to provide adequate treatment capacity for the year 2000 ADWF from its service area. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-14. The estimated project costs of the facilities required for this alternative are given in Table 16-37.

Alternative V. Alternative V involves enlarging and upgrading the five existing wastewater treatment plants in the study area. At least two disposal options are considered for each discharger as follows: Goleta Sanitary District — spray irrigation, percolation, ocean disposal or stream disposal; City of Santa Barbara — ocean disposal or stream disposal; Montecito Sanitary District — ocean disposal, stream disposal or percolation into the Carpinteria groundwater basin; Summerland — ocean disposal, stream disposal, spray irrigation or percolation into the Carpinteria groundwater basin; and Carpinteria — ocean disposal, spray irrigation, percolation or stream disposal.

For the Goleta Sanitary District and the City of Santa Barbara, land disposal by spray irrigation could occur on the slopes of the Santa Ynez Mountains north of the areas of expected future urban development during the summer months. Because of the rough terrain, a much lower spray irrigation application rate would be used and the cost of distribution facilities would be higher. It is assumed that biological secondary treatment with disinfection would be necessary prior to spray irrigation land disposal. One of the effluent pumping stations which would be necessary to convey the treated wastewater to the land disposal area would be used to increase the capacity of the ocean outfalls. The ocean outfalls would be used during the winter months when the precipitation rate exceeded the evapotranspiration rate.

For Summerland Sanitary District, spray irrigation with storage at a site within a mile of the WTP has been investigated. Land use plans call for urban land uses of all the land near the WTP. Thus any plans for spray irrigation near the WTP will create land use conflicts.

Disposal by percolation into either the Goleta or Carpinteria groundwater basin will require nitrogen removal and increased groundwater quality monitoring. The Goleta Sanitary District ocean outfall could be used intermittently or a portion of the average flow could be discharged to the ocean. Extension of the Carpinteria Sanitary District ocean outfall would be necessary prior to such use.

Stream disposal would require biological oxidation with nitrification, effluent filtration and disinfection to an MPN of 2.2 coliform per 100 ml and dechlorination. With this degree of treatment, there could be unrestricted recreational use made of the reclaimed water in the streams. If sufficient recharge of the groundwater basins occurred so that the nitrate level of groundwaters approached 10 mg/l as nitrogen, then nitrogen removal facilities might become necessary at some time in the future. This alternative would require that groundwaters in the vicinity of the streams be regularly monitored to ascertain their nitrate content.

With the ocean disposal option, for planning purposes it is assumed that the Summerland ocean outfall would be extended to 35 feet of depth and the Carpinteria outfall to 1,000 feet beyond the 35-foot depth contour and multiport diffusers constructed. The facilities required to implement this alternative for year 2000 flows are illustrated in Fig. 16-14. The estimated project costs of the facilities required for this alternative are given in Table 16-37.

Other Alternatives. Many other alternatives were investigated and dropped from further consideration because of unreasonable cost or significant adverse environmental impact. Examples include plans to export the combined wastewater flow out of the sub-basin, plans to convey all wastewaters to a single treatment facility and plans to discharge treated wastewaters to coastal wetlands which provide habitat for endangered species.

Reuse Options. A characteristic of the alternative plans considered in the previous paragraphs is that they all provide a reliable, fail-safe disposal system which will protect the beneficial uses of receiving waters, prevent nuisance conditions and protect public health. In each instance, the characteristics of the disposal option are such that disposal can continue on a year round basis (independent of the demand for water by vegetation, for example). In addition, normal variations in effluent quality expected from well designed treatment plants will not threaten public health. These perennial and assimilative characteristics of the disposal options distinguish between options for disposal and options for reuse.

As distinguished from wastewater treatment and disposal, reclamation of water from wastewater has as its primary objective the production of water of quantity and quality for a specific use. It can, and indeed often must, be selective as to the quantity and quality of wastewater accepted for reclamation and is not necessarily concerned with the final disposal of the waste matter removed in the process of reclamation. In most cases, therefore, any plans for water reclamation should be analyzed independently of a wastewater treatment and disposal system.

The reuse of treated wastewater requires that (1) a demand for reclaimed water exist, (2) a supply of reclaimed water of sufficient quality for the particular reuse be available, and (3) a conveyance system from the wastewater reclamation plant to the location of the demand be provided. Because the Santa Barbara Coastal Sub-basin is a water-short area, it is assumed that the first requirement can be fulfilled if reclaimed water of adequate quality can be provided at a cost which is reasonably competitive with the cost of other supplemental water supplies.

When the City of Santa Barbara commissioned a study of wastewater treatment and disposal alternatives in 1970-71, the potential for wastewater reclamation and reuse in the Santa Barbara and Montecito areas was also studied. The report to the City quoted preliminary costs of providing reclaimed water which ranged from $86.00 to $129.00 per acre-foot, for landscape irrigation and injection into the groundwater basin, respectively. Both of these costs are somewhat higher than the present cost of water in the City of Santa Barbara, but they are less than the costs of imported State Project Water as previously mentioned.

The city has also recently initiated a very comprehensive feasibility study of several types of wastewater reuse which includes the development of a pilot wastewater reclamation system to demonstrate the feasibility of wastewater reuse in the study area. Data will be gathered during the study to enable the design of a full-scale reclamation system.

The foregoing studies indicate that wastewater reclamation and reuse are being considered as a supplemental water supply for the Santa Barbara Coastal Sub-basin. The costs of reclaimed water noted above do not reflect the impact of State/Federal grants on reclaimed water facilities, which may result in significantly lower costs to the user. The degree to which each of the alternative plans encourages wastewater reclamation and reuse, therefore, is an important consideration in the evaluation of the plans.

Industry. Land use plans for the Santa Barbara area do not envision industrial land use as a significant future use of land. In addition, it is expected that most of the industrial activity will be conducted by "dry" industries, which would generally not include heavy water users. Thus, at present, the potential for industrial water reuse in the area is low.

Domestic Use. It is highly unlikely that direct domestic reuse, which is presently prohibited by the State Department of Health, will be implemented until all sources of new water supply have been exhausted. In the event that planned programs to import water are not implemented or fail to meet the ultimate needs of the area, the first step would be to substitute reclaimed water for the potable supplies now used for agriculture, recreation and land beautification purposes. Only then is consideration likely to be given to the reclamation of wastewater for domestic use. On the basis of present conditions, therefore, it must be concluded that this form of water reuse may not need to be considered in detail for many years.

Groundwater Recharge. Inland groundwater recharge to add to the groundwater resources of the sub-basin or coastal groundwater recharge to form a barrier to seawater intrusion exhibit significant potential in the study area. Both the use of percolation basins and direct injection wells should be investigated at the project level. Such investigations will necessitate detailed exploratory geological studies and a much more definitive knowledge of the hydrogeology of the area than is currently available.

Streamflow Augmentation. The potential for augmenting the flow of several of the perennial streams in the region should be investigated more fully. Because this reuse will necessitate a higher level of treatment than ocean disposal, it may be more economical to treat a portion of the total wastewater flow for use to augment streamflow rather than to dispose of all wastewaters in the stream channels.

Summary. The previous discussion has indicated that the outlook may be favorable for the reuse of reclaimed water for agriculture, recreation and land beautification, groundwater recharge and streamflow augmentation. These forms of reuse should be considered in detail at the project planning level and alternative plans which encourage their implementation should be favored.

Comparison of Alternatives — Santa Barbara Coastal Region

In the following paragraphs, an evaluation of each of the alternatives is presented. Comparison of the economic, environmental and functional characteristics is accomplished and the recommended plan is selected.

Economic Evaluation. An economic evaluation of the costs of staged construction of facilities required to meet projected wastewater demands until the year 2000 is presented in Table 16-37.

In order for each service area to further evaluate its economic advantage or disadvantage in joining a regional system, the total costs were allocated among the entities. Allocation of costs was based on the percentage of average dry weather design flow in each facility. It must be emphasized that this is only one of several methods of allocating costs and is selected for this report only to give an indication of the cost allocation for the purpose of comparison of alternatives.

The total capital and total annual costs of alternatives IV and V with ocean disposal are significantly less than the costs of alternatives I, II, and III. The total capital and total annual costs of alternatives III and IV are essentially the same. Feasibility cost estimates favor either ocean, land or stream disposal or conveyance to the Montecito Sanitary District WTP of the wastewaters from the Summerland Sanitary District.

Functional Evaluation. Alternative water quality management plans are also compared on a functional basis by considering issues which include operational and institutional factors. The analysis of intangible factors is displayed in a matrix wherein the scoring of each alternative is compared according to factors rated. The analysis of the functional factors of the alternatives for each service area is presented in Table 16-38.

In general, alternative V with ocean disposal is ranked highest, with alternative IV a close second. A large degree of consolidation of wastewater treatment in the Santa Barbara Coastal Region would build into the wastewater management system much inflexibility to changes in the rate of population growth. This is an important matter to consider in this study area where the future rate of population growth is very uncertain. A large amount of consolidation of wastewater treatment would also discourage wastewater reuse for landscape irrigation, which at this time seems to exhibit the greatest potential in the study area. Elimination of the very small WTP at Summerland and conveyance to the Montecito WTP, however, might increase the reliability of the wastewater management system.

FINANCIAL ASPECTS

Financing is a major consideration in planning for wastewater systems. This discussion is divided into several sub-topics including methods for securing financing for various alternatives and recommendations contained herein.

Possible Cost Sharing Arrangements

Common cost sharing arrangements for wastewater agencies include capacity purchase, proportionate to assessed valuation and proportionate to overall savings.

Another method sometimes used in areawide systems is regional sharing of revenues, costs and capacity. The effect is sharing of costs in proportion to revenues collected from each area under a uniform system of charges. This method assumes that a desirable goal is a uniform charge for a uniform level of service. Costs are allocated on a year-by-year basis in proportion to the amount of revenue collected under a uniform system of charges. In conjunction with this method, the regional agency usually compensates member entitlees for existing major facilities to equalize the cost of these facilities throughout the service area. Connection charge revenues are used in the compensation program so that all areas benefit from new development regardless of where it occurs.

Table 16-38. Evaluation of Functional Factors of Alternatives, Santa Barbara Coastal Region

Service area/factor	No action	Alternative I Ocean disposal	Alternative II Ocean disposal	Alternative III Ocean disposal	Alternative IV Ocean disposal	Alternative V			
						Ocean disposal	Stream disposal	Percolation	Spray irrigation
Goleta Sanitary District									
Effectiveness	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Marginal	Marginal	Poor[a]
Reliability	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	Excellent	Adequate
Flexibility	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Marginal	Marginal
Implementation	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	Poor	Poor
Reclamation potential	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	Excellent	Excellent	Excellent
Compatibility	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	Marginal	Marginal
Overall rating	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	Marginal	Marginal
City of Santa Barbara									
Effectiveness	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Marginal	NA	Poor[a]
Reliability	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	NA	Adequate
Flexibility	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	NA	Marginal
Implementation	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	NA	Poor
Reclamation potential	Marginal	Adequate	Adequate	Adequate	Adequate	Adequate	Excellent	NA	Excellent
Compatibility	Poor	Marginal	Marginal	Marginal	Excellent	Excellent	Excellent	NA	Marginal
Overall rating	Poor	Adequate	Adequate	Adequate	Excellent	Excellent	Adequate	NA	Marginal
Montecito Sanitary District									
Effectiveness	Poor	Marginal	Marginal	Marginal	Excellent	Excellent	Marginal	Marginal	NA
Reliability	Poor	Adequate	Adequate	Adequate	Excellent	Excellent	Adequate	Adequate	NA
Flexibility	Marginal	Marginal	Marginal	Marginal	Excellent	Excellent	Excellent	Marginal	NA
Implementation	Poor	Marginal	Marginal	Marginal	Excellent	Excellent	Marginal	Marginal	NA
Reclamation potential	Marginal	Poor	Poor	Excellent	Excellent	Excellent	Excellent	Adequate	NA
Compatibility	Poor	Adequate	Adequate	Adequate	Excellent	Excellent	Adequate	Adequate	NA
Overall rating	Poor	Marginal	Marginal	Adequate	Excellent	Excellent	Adequate	Adequate	NA
Summerland Sanitary District									
Effectiveness	Poor	Marginal	Marginal	Marginal	Excellent	Excellent	Excellent	Marginal	Excellent[b]
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Excellent	Adequate	Adequate	Excellent
Flexibility	Marginal	Marginal	Marginal	Marginal	Marginal	Excellent	Excellent	Marginal	Excellent
Implementation	Poor	Marginal	Marginal	Marginal	Adequate	Excellent	Excellent	Marginal	Adequate
Reclamation potential	Marginal	Poor	Poor	Excellent	Adequate	Adequate	Excellent	Adequate	Excellent
Compatibility	Poor	Adequate	Adequate	Adequate	Excellent	Excellent	Excellent	Adequate	Poor
Overall rating	Poor	Marginal	Marginal	Adequate	Adequate	Excellent	Excellent	Adequate	Adequate
Carpinteria Sanitary District									
Effectiveness	Poor	Marginal	Excellent	Excellent	Excellent	Excellent	Adequate	Marginal	Poor[b]
Reliability	Poor	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate
Flexibility	Marginal	Marginal	Excellent	Excellent	Excellent	Excellent	Excellent	Adequate	Adequate
Implementation	Poor	Marginal	Excellent	Excellent	Excellent	Excellent	Adequate	Marginal	Marginal
Reclamation potential	Marginal	Poor	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Compatibility	Poor	Adequate	Excellent	Excellent	Excellent	Excellent	Adequate	Adequate	Adequate
Overall rating	Poor	Marginal	Excellent	Excellent	Excellent	Excellent	Adequate	Adequate	Adequate

[a] With ocean outfall

[b] With storage

The straight capacity purchase method often results in longterm inequities and severe financial burdens when actual growth proves greatly different from projected growth. In a modification of this method the participating agencies may agree to develop a contractural arrangement whereby the local capital cost of joint facilities will be reallocated annually to reflect actual use. The actual percentage of use for each agency is determined by dividing the measured volume of sewage flow on a particular day or days by the total flow from all agencies.

As final system plans evolve, a detailed financing study should be made in each study area unit to determine the most suitable cost sharing arrangement.

Outstanding Debt Problems

Several agencies have outstanding direct debt that is so high relative to assessed valuation that they should not assume additional debt. The agencies are not legally constrained from issuing additional bonds, but such high existing debt would make it difficult to sell additional bonds. The only alternative may be to delay new bonds until a substantial portion of the existing debt has been retired. In each case, a detailed financial plan must be prepared at the project report level; accordingly, water quality control plans described herein do not attempt to draw up specific compromises between water quality needs and community financing difficulties. This kind of approach should be thought of as a cost-effective analysis between action and no action alternatives. Some examples of such financing problems are:

1. Chualar CSD, with a direct debt/A.V. ratio of 20.3 percent is in a particularly poor position since bonds of agencies with ratios in excess of 20 percent are not a legal investment for banks in California. Since these banks are major investors in municipal bonds, this would severely limit the market for Chualar CSD's bonds.

2. Marina CWD, with a ratio of 15.7 percent, is not in a sound position but does not suffer from the legal constraints on bank investments. Its problem is eliminated if, as recommended in this study, it joins with the other Monterey Peninsula dischargers to form an umbrella agency under a joint power agreement. The bonds issued by the umbrella agency would be secured by the total A.V. of the participating agencies; since the other agencies have relatively low debt/A.V. ratios, Marina CWD's debt would not be an excessive burden.

3. Zone 3 of San Luis Obispo County Flood Control and Water Conservation District (Lopez Recreation Area) has outstanding debt that is already so high relative to its assessed valuation that it is in an unsound position to assume additional debt. With a direct debt to A.V. ratio of 32.0 percent, the agency is in a particularly poor position since bonds of agencies with ratios in excess of 20 percent are not a legal investment for banks in California. Because these banks are major investors in municipal bonds, this would severely limit the market for Zone 3's bonds. The agency is not legally constrained from issuing additional bonds, but to do so with such high existing debt would raise interest costs. One alternative is to delay new bonds until a substantial portion of the existing debt has been retired.

Contributions. In some instances, a sewering agency may require developers and others to pay capital costs for new facilities which will connect them to the existing system. A typical example is where a developer subdivides property that is remote from an existing sewer main. The public agency will then negotiate a main extension agreement with the developer. The developer will pay the cost of construction for the main extension. The agreement will provide for reimbursement of a portion of his costs from connection charge revenues as new customers connect to the extended sewer main.

Similarly, an industry or public institution may require a long connecting sewer or special sewerage facilities, and may agree to finance the capital costs. Under a contract arrangement the sewering agency will agree to repay a portion of this cost from connection charges or other revenues related to the special facilities provided.

Revenue Sources. Federal and state regulations and guidelines related to the Clean Water Grant Program include some rather specific requirements with regard to revenue programs for wastewater agencies. Federal regulations for "User Charges and Industrial Cost Recovery" state in effect that:

1. A grant applicant must develop and implement a system of user charges to assure that each recipient of waste treatment services will pay its proportionate share of the costs of operation and maintenance (including replacement) of treatment works provided by the applicant (paragraph 35, 925-11).

2. The user charge system shall distribute costs in proportion to each user's contribution to the total wastewater loading (Appendix B, paragraph (f)(1)).

The State's "Revenue Program Guidelines for Wastewater Agencies" goes a step further and introduces a utility concept of depreciation accounting. The guidelines state that total annual capital expense, including bond and loan principal payments, should exceed annual depreciation thus assuring that the total annual investment in new facilities will be such that the value of the system will be maintained.

The following discussion of revenue sources provides a general background on establishing an equitable system of user charges.

Property Tax is an ad valorem property tax that often provides revenue to support wastewater systems. Often in practice, and sometimes by statute, the use of the property tax is limited to raising an amount necessary to pay debt service on agency borrowing and to finance expenses not related directly to operation and maintenance costs, for example administrative and general overhead expenses of the agency.

Use of the property tax is further limited by SB 90, as amended by AB 2008 (Statutes of 1972, Chapter 1406; and Statutes of 1973, Chapter 358). These generally require voter approval in cities, counties, and special districts for any property tax rate greater than the maximum rate which was levied in either fiscal 1971/72 or 1972/73. There are, however, several notable exceptions to this rule:

1. For a general law city, if the aggregate citywide tax rate for fiscal years 1971/72 and 1972/73 was less than one dollar, the maximum rate is one dollar. In addition any property tax rate authority by the voters, which was not levied in the base fiscal year selected by the city council, may also be levied.

2. For a charter city or special district, if a maximum property tax rate is provided by charter or by statute and is greater than the rate levied in either fiscal 1971/72 or 1972/73, the rate specified in the charter of statute is the maximum rate.

3. Taxes in excess of the maximum rate may be levied in accordance with a specified formula relating growth in population or assessed valuation and the cost of living to the tax rate. This provides additional ability to tax in high-growth cities and districts.

With respect to the facilities proposed in this report, AB2008 apparently permits agencies to increase the property tax without a vote to finance wastewater facilities mandated by federal requirements. The State Board, however, has published a tentative opinion that even though an agency is required to finance wastewater facilities mandated by Porter-Cologne Act requirements, the local agency will not be able to increase its property tax, nor will it be entitled to reimbursement from the state. This opinion is based in part on the fact that the local agency has the ability to finance state mandated facilities by levying rates and charges without increasing property taxes.

In the past many cities have used property tax revenue from the general fund to support all wastewater system costs, making no attempt to distinguish between wastewater fund operations and other operations. The tendency now is to set up a strict wastewater fund accounting system, and to operate the wastewater system like any other utility.

The property tax as a revenue source although limited by SB 90 as amended by AB2008, has a number of advantages:

1. It is simple and inexpensive to apply and administer, requiring no sampling, surveying, quantity measuring, or special accounting and billing.

2. It provides for financial support from undeveloped property, both to reflect general benefit from the wastewater system and to pay part of the cost of infiltration waste loads.

3. Individual property owners can report property tax expense as a deduction on federal income tax returns.

This latter advantage may offset the fact that owners of more expensive homes pay relatively more for sewer service when revenue comes strictly from a property tax. These homeowners are generally in the higher tax brackets and so benefit more from any deductible expense.

Capital expenses, certain fixed operating expenses, and benefits to undeveloped property relate more to a readiness-to-serve concept than to actual service factors such as flow volume and loadings. Again, the property tax may be an equitable way to spread costs.

Clearly, however, the greatest inequities arise when the property tax is the sole source of revenue and there are major industrial users of the wastewater system. The charge may be disproportionately high when industries or commercial installations produce little or no wastewater in relation to property value. The charge may be disproportionately low when an industry contributes a large volume of wastewater, possibly with high BOD or other loadings.

To achieve equity, it is necessary to establish a system of service charges related to flow and loading, possibly in conjunction with application of a property tax.

Service charge. A wastewater service charge must reflect system use in some way. It may be set to cover only the costs of operation and maintenance, or it may cover other expenses including debt service and other costs.

Ways that systems of user charges are tied to physical use of the system include:

1. Flat charge per dwelling unit or equivalent

2. Flat charge per fixture unit

3. Water use

4. Water use plus a surcharge for nondomestic loadings

5. Measured volume of discharge

6. Measured volume of discharge plus a surcharge for nondomestic loadings

A user charge system based only on physical use of the system ignores benefits to undeveloped property, infiltration contributions from undeveloped property, readiness-to-serve costs, and ability-to-pay factors. It also ignores the value to the general community of health protection and water quality enhancement. Supplemental revenues from an ad valorem property tax or a standby charge can help spread costs to all beneficiaries.

With a service charge based on water cost it is important to avoid quantity discounts to large volume users. Economics of scale should be shared by all classes of users. At the same time allowances can be made for water volume that is not returned to the sanitary sewer; for example, irrigation water, and water retained in industrial processes. Where the water system is metered a sewer user charge system based on water consumption is a simple, practical method of generating sewer fund revenues.

A metered rate provides an incentive for users to reduce water and sewer use. This conserves water resources and lowers the operating cost of both the water and wastewater systems. The effect of a metered rate on residential and commercial use is generally quite small. On the other hand, industrial water and sewer use is quite sensitive to metered rates. Because of this, measurement and flow devices to monitor waste discharges of the larger industrial sources are essential, both to permit an equitable user charge system, and to encourage industry to limit water use, to improve processes and to apply reclamation principles.

Where water service is not metered, or water billing is not easily adapted for sewer service charge purposes, a flat monthly charge per dwelling unit or equivalent provides a simple user charge method. Businesses and industries having only domestic-type wastes can pay monthly charges related to fixture units or number of employees.

An appropriate rate structure for many agencies would combine the following:

1. A flat rate for residential and commercial connections

2. A metered rate for high-volume dischargers

3. A standby charge or property tax component to cover general system benefits

4. A surcharge for loadings from industry.

Connection charge. This type of charge, collected at the time a new user connects to the wastewater system, can be an important source of project financing. This is particularly true in a growing community. It should be a substantial charge to compensate the community for providing major sewerage facilities in advance of need. In most cases a connection charge of several hundred dollars is economically practical for new development under present market conditions. It may also escalate $25 to $50 per year to encourage early connection and to compensate for the future value of present investment.

Since the connection charge tends to spread costs over property that is newly developed, the size of the charge may be influenced by whether or not a sewer tax or standby charge was levied on the property prior to development.

Dwelling unit equivalents for commercial property connection charges are usually related to property area, square footage in the building, equivalent fixture units, or anticipated water usage. Connection charges for industry with unusual wastewater problems should be based on a separate engineering study for each service, including a consideration of wastewater volume and strength.

Financial Feasibility

Future water quality management will involve much greater capital and operating costs than have the ongoing wastewater programs. The financial burden and the problems to be considered in present planning are going to increase rapidly during the next several years.

The problem of project financing is considered in two ways in this study: the local cash requirement for initial construction of the project and the annual cost to the individual user. The local cash required for initial construction (prior to 1980) is assumed to be raised through the sale of tax exempt bonds, the principal amount of which is determined by including in the bond issue a year's debt service plus a year's interest as well as the local share of capital costs. The engineer's estimate of capital costs includes an allowance for engineering, fiscal and legal services, and contingencies. Annual cost to the individual user is calculated as the average charge necessary to meet annual operation and administration costs, debt service, direct capital outlay, and contributions to capital reserves.

Financing costs are projected to 1980, coinciding with the time when feasibility-level plans will have been implemented. By that time, the proposed initial phases of construction will have been completed, and annual expenditures will have stabilized. Beyond 1980 many factors such as population, assessed valuation, or inflation could drastically alter the financial solution for a given project such that further extrapolation would be meaningless. Specific financial projections related to project expenditures beyond the feasibility planning period should be deferred until plans are more definite.

In estimating local cash requirements, several assumptions are made:

1. Since state and federal grants are presently set at 12.5 percent and 75 percent of total project costs, the local share is 12.5 percent of total costs.

2. The bonds issued to finance the local share will be 25-year serial bonds at a six percent rate of interest with a 5-year buildup period to a uniform total debt service. This buildup period is intended to lessen the financial impact of major capital improvements during the initial period when revenues are not yet up to their full potential, and interest payments are high.

3. The amount of the bond issue will be greater than the local share of construction costs in order to have sufficient funds from bond proceeds to pay the first year's interest and to hold a full year's debt service in reserve. The total amount of the bond issue would then be 1.16 times the local share of project costs. If general obligation bonds are used, the debt service reserve would be unnecessary, reducing the size of the bond issue to 1.06 times the local share.

Estimates of user costs, shown in Table 16-39, are based on the engineer's estimates of costs, financial data taken from questionnaires which were sent to existing dischargers, and Department of Finance population estimates. Where financial data are not available for a specific discharger, assumptions are made concerning the projected number of connections and growth rate for assessed valuation, based upon observations in other areas. The particular assumptions used are specified in the footnotes to the table.

Revenues are estimated on the basis of a combination of connection charge, service charge, and property tax. A level of charges and a tax rate were selected that would be realistic relative to charges that are presently levied for sewerage service. The rates used are a connection charge of $475, a monthly service charge of $4.00, and a sewer tax rate of $0.50 per $100 of assessed evaluation. Using a 7.5 percent annual cost inflation factor, equivalent charges today would be $286 for each new connection, $2.40 for the monthly service charge, and $0.30 for the sewer tax rate.

With such a rate structure, the total number of chargeable connections, the number of new connections per year, and assessed valuation (A.V.) projections are needed in order to calculate revenues. These are projected to 1980 on the basis of historical growth of connections and A.V. for the period 1967 to 1972. Where growth data is not available, the estimates are related to population projections. The number of connections, new connections per year, and A.V. are then multiplied by the respective rates and added together to get total annual revenues for 1980.

The total annual expenditures consist of administration and operation costs, debt service (principle payments plus interest on outstanding debt), and payments to the Wastewater Capital Improvement Fund (WCIF). The administration and operation costs are derived from the engineer's estimate for 1975 projected to 1980 at a 7.5 percent rate of inflation. Debt service includes both existing debt service, taken primarily from bond retirement schedules, and new debt service required to finance the proposed facilities, based on the engineer's estimate of project construction costs. The annual payment to the WCIF is calculated as the annual depreciation expense of the existing and proposed facilities, less the total principal payments on debt.

Most of the expenditures are self-explanatory, but the WCIF requires additional discussion. Establishment of such a fund is a requirement for receipt of the state's Clean Water Grants. The WCIF is a capital reserve fund intended to be used for future capital improvements to the wastewater system. The concept underlying the formula for calculating the WCIF accruals is that total annual capital expense, that is, bond principal payments, capital outlay, and WCIF accruals, should equal or exceed annual depreciation. Thus, over the useful lifetime of equipment and facilities their full costs will have been repaid through local revenues. This will create a reserve fund, the WCIF, to improve and enlarge wastewater facilities even in the absence of state and federal grants.

Having estimated total revenues and total expenditures, cost to the individual user in 1980 can be calculated. Expenditures are subtracted from revenues, yielding the net revenue (deficit) produced by the "reasonable" rate structure chosen. The tax rate is then recalculated to determine the rate necessary to produce a balanced annual budget. This is shown as the "Indicated Tax Rate" in Table 12B. Where the indicated tax rate is less than $2.00, the annual cost to the individual user is calculated as the cost to the owner of a $20,000 home (dwelling unit) based on the indicated tax rate and a service charge of $4.00 per month. Where the tax rate is greater than $2.00, the cost to the individual is calculated as the average cost per connection, i.e., total expenditures divided by total connections. For the projects which include the possibility of water softening, both cost per dwelling unit and cost per connection are calculated. This does not mean that adjustments in charges should be made in this manner; it is simply a way of deriving user costs that would most realistically reflect annual charges to the user under the proposed plan.

Both of the financial criteria, local bond requirements and cost to the individual user, indicate that there would be financial problems for several projects under the proposed plan. In general, these are small, lightly populated areas with low assessed valuation per connection which cannot achieve the economics of scale that the larger, more urbanized regions can. Neither direct charges for connection nor future tax base seem able to support the proposed facilities without excessive expense to the users. Specifically, the areas which would have difficulty financing proposed projects are Davenport, Chualar, Shandon, San Simeon Acres Community Services District, Santa Ynez Community Services District, Nipomo, Guadalupe, Avila Sanitary District, and Summerland Sanitary District. The estimated annual cost per connection in these service areas ranges from $209 for Guadalupe to $969 for San Simeon Acres CSD.

For Guadalupe much of the financial burden is created by the additional cost of water softening. The rationale for water softening is that it not only upgrades the quality of the wastewater, making treatment easier and less costly, but it also gives users the benefit of improved water quality. Because of this additional benefit, the costs of service are not strictly comparable to areas that do not require water softening. If demineralization is used instead of water softening, the tax rate is reduced from $5.19 to $3.59, but the water supply would not be improved prior to its use.

Remedial Measures to Alleviate Financial Hardship

Rigidities in the present laws will create financial problems for several areas. Davenport SMD, Chualar CSD, Shandon (San Luis Obispo CSD No. 16), San Simeon Acres Community Services District, Nipomo, Guadalupe, Avila Sanitary District, and Summerland Sanitary District will simply be unable to finance any major plan to

Table 16-39. Estimate of User Cost in 1980[a]

Discharger	Assessed valuation[b]	Total revenue[b]	Total expenditures[b]	Indicated tax rate[c]
Davenport	89	4	32	31.53
Santa Cruz Regional Plant	225,000	2,793	2,345	0.30
Wastonville Regional Plant	71,400	1,112	1,337	0.81
Gilroy Regional Plant	121,800	1,229	1,124	0.41
Hollister Regional Plant[d]	30,400	394	924	e
Monterey-Salinas Regional Plant	328,000	4,242	4,145	0.47
King City	13,300	142	527	e
Greenfield	3,900	65	89	1.11
Soledad	4,000	123	134	0.78
Chular	290	6	61	19.74
Gonzales	4,900	89	94	0.60
Paso Robles	20,900	218	334	1.06[f]
Atascadero	18,400	207	434	1.73[f]
Carmel CSD	83,000	737	569	0.30
San Simeon Acres	1,600	15	95	5.39
Cambria	14,300	112	155	0.80
Morro Bay/Cayucos	44,100	507	354	0.15[g]
San Luis Obispo	103,700	998	825	0.33
Avila Beach	700	14	90	11.37
Pismo Beach	28,900	258	323	0.72
San Luis Obispo County SD	17,000	337	408	0.92
Guadalupe[h]	3,600	87	217	3.59
Santa Maria[h]	205,700	1,482	1,872	0.69
Laguna County SD[h]	27,900	432	498	0.74
Lompoc Regional Plant	42,600	667	818	0.85
Buellton CSD	6,100	77	112	1.07
Solvang MID	12,700	116	166	0.89
Goleta SD	102,400	1,633	981	0.00
Santa Barbara	203,400	1,854	1,982	0.56
Montecito SD	53,900	368	251	0.28
Summerland SD	3,200	31	97	2.54
Carpinteria SD	21,400	190	306	1.04

[a] Municipal dischargers only; state and federal facilities and private sewerage entities not listed. Costs which may pertain to existing unsewered areas are not listed, since sewerage feasibility studies are called for in most cases. More detailed breakdowns of financial feasibility considerations contained in Task Reports prepared by Bartle Wells Associates, September, 1973.

[b] Assessed values (AV) are in $1,000; revenues and expenses are in $1,000/year.

[c] Tax rates are expressed as $/100 AV; cases having high indicated tax rate are discussed in the text, and costs per connection are indicated therein.

[d] Includes San Juan Bautista.

[e] Substantial industrial flows make it difficult to compute realistic tax rate.

[f] Costs shown are based on AMBAG study; revommended plan for Paso Robles and Atascadero involve less consolidation, which will reduce costs from those shown.

[g] Indicated tax rate probably low; project cost will depend on land disposal site selection which could affect design of nitrogen removal facilities.

[h] Costs reflect demineralization option; water supply improvements recommended are not covered by state-federal grants.

upgrade sewerage facilities. The major reason for this difficulty is the high cost associated with conventional secondary treatment and sewering costs. For Guadalupe, the cost of municipal water softening is an additional factor.

It should be noted that several of these areas which would have financial difficulty implementing sewerage improvements may be able to stage this work or even reduce the cost of the project. For example, sewerage feasibility programs recommended for Shandon and Nipomo may result in reduced project costs or may determine that a sewerage system is not necessary so long as septic tank management is properly administered (see Chapter 5). A delayed solution for the Davenport area may prove to be acceptable and oxidation pond systems may be cost effective here and in many other rural areas, such as Salinas Valley. A delay in effecting secondary treatment at Avila Beach has been suggested wherein physical-chemical treatment could be provided as an intermediate step. These approaches, suggested in Chapter 5, recognize the financial difficulty with early implementation of more conventional wastewater facility projects.

On a broader scale, there are measures which can be taken to alleviate financial hardship. Potential solutions are:

1. Tie into a regional system. If other dischargers are close enough to the financially weak discharger, a regional wastewater management system could be developed. Since the recommended plan in each case is also the least costly, this new regional system would result in a higher total cost. Nonetheless, a lower cost to the financially weak discharger could result because of the distribution of the costs over a larger number of users. The other dischargers would have to pay a higher cost per user than under the recommended plan, in effect subsidizing the financially weak discharger. There is some justification for such a subsidy in that every discharger contributes to the basin's water quality by treating its wastes, but there is no economic incentive or legal requirement that is likely to bring it about.

2. Tax Subsidy. Rather than physically tying into a regional system, a broadly based government, for example the county, could tax all of the dischargers and subsidize those which could not afford to pay for their own treatment. The rationale for the subsidy is, once again, each discharger's contribution to water quality. The difference between a pure tax subsidy and a subsidy based on a regional system is that the tax-subsidized facility can retain the same physical configuration as the recommended plan, thus reducing both total costs and the amount of the subsidy. The problem with the tax subsidy is exactly the same as with the regional system: there is no means of inducing or compelling the dischargers to cooperate.

3. Permit a lower level of treatment. Allowing primary treatment or septic tank disposal would substantially reduce costs. However, in some cases this would be in violation of the Federal Water Pollution Control Act Amendments of 1972. In addition, lower levels of treatment may have a detrimental effect on water quality. If environmental studies show that lower levels of treatment for financially weak dischargers do not reduce water quality and if financial problems are prevalent in other basins, redefinition of secondary treatment requirements would be warranted. In that case, the State Water Resources Control Board (SWRCB) should approach the EPA administrator on behalf of these dischargers and request modification of the requirements. The SWRCB might also contact other states to see if their problems are similar. For example, the use of oxidation ponds or other low cost, low energy systems could be encouraged in rural areas. Where land disposal is emphasized during the dry season there would be some dispensation given (in terms of effluent limits) where discharge to surface waters was limited to periods of substantial runoff. If such solutions were found workable the states could submit a joint request to the EPA administrator. Implementation of the recommended plan will be financially infeasible for the indicated projects unless one of these solutions is instituted. Statutory language regarding power over water reclamation and reclaimed water deserves special mention as certain difficulties arise as more agencies begin to reclaim water. Authority over reclaimed water is not clearly defined in current legislation. While some legislative codes specifically identify this function or have been amended or updated to clarify an agency's powers, most statutory language is imprecise. As local institutions are required to extend the scope of their wastewater/sewerage service to meet federal and state guidelines, statutory authority will have to be updated to clearly define agency powers in this area.

Total water management should be encouraged by specific inclusion of wastewater reclamation and water supply enhancement. Where water supply is limited, such as in the Santa Barbara coastal area, water supply agencies, including irrigation districts, should be encouraged to take treated wastewater destined for ocean discharge and provide appropriate treatment for reuse. Reuse possibilities will probably increase in the future and may include indirect or direct recycle to public water supplies; however current public health regulations limit reuse to crop irrigation and recreation-oriented purposes. Agencies should be encouraged, by grant incentives where appropriate, to provide additional treatment necessary to permit unrestricted irrigation or recreation uses of wastewaters.

4. Increased state and federal grant or loan assistance. Where mineral quality of groundwaters is degraded and where recommended water quality control plans call for reduction in effluent mineral content, it is recommended that water supply quality improvements be incorporated in the plan where such measures are of greater overall benefit than effluent demineralization. Local funding problems will inhibit implementation of total water management programs involving water supply improvements unless federal grant legislation can specifically include water supply improvements for this particular purpose. Similarly, where sewers are required, the eligibility of sewering programs for grants could be adjusted to further assist projects having demonstrated financial hardship. Use of state or federal low interest loan programs could also assist such projects.

5. Staging the necessary improvements. The initial financial burden can be reduced by staging of facility improvements. This approach is often used in sewerage works wherein the extent of the sewer service area can be increased in a logical sequence following a previously approved master plan. Similarly treatment plant improvements can be staged in terms of the level of treatment and the extent of reliability provided. Upgrading of treatment may not be possible in terms of timetables prescribed by present law, but an implementation schedule should be followed to stage upgrading in an orderly and financially feasible manner. Examples of staging to effect compliance over a longer timeframe have been cited for several communities in the basin where financial hardship or other priorities suggest deviation from the 1977 deadline for secondary treatment.

Financing Resources

Public agencies in California have a variety of financing methods available both for operating expenses and for major capital improvements and enlargements. Most common among these financing methods are:

Capital Sources

General Obligation Bonds

Revenue Bonds

Assessment Bonds

Pollution Control Financing Authority Bonds

Promissory Notes

Federal Grants

State Grants

Contributions

Revenue Sources

Property Tax

Service Charge

Connection Charge

Standby Charge

Interest Earnings and Miscellaneous

Some agencies are restricted from using some of these financing methods, but many agencies have access to all those listed. Less common, but available to some, are such things as grant anticipation notes and special assessment powers of various kinds.

General Obligation Bonds. A general obligation bond is one backed by the full faith and credit of the issuer, for the payment of which the issuer may levy ad valorem general property taxes without limit as to rate or amount. The issuer need not actually levy such taxes but may instead use revenues from service charges or other sources to meet the required payments on general obligation bonds.

Because the bonds are secured directly by the power to tax, they usually command a lower interest rate than other types of bonds. Because of their security features, their tax exempt status, and their general acceptance by the bond market, general obligation bonds lend themselves readily to competitive public sale at the lowest interest cost available to the borrower. For the same reasons, it is generally true that the overhead costs of financing-engineering, legal, and financial are less for an issue of general obligation bonds than for a comparable issue of revenue bonds. Bidders on a more or less standard general obligation bond issue do not require the detailed engineering surveys and reports, complex legal covenants, and extensive financial analyses necessary in connection with revenue bonds.

The issuance of general obligation bonds by many local units of government is limited to a stated percentage of the total assessed valuation of taxable property, generally 15 to 20 percent. Sometimes exceptions are permitted, particularly in the case of bonds issued for self-supporting projects, or bonds issued for specific purposes, such as water supply or sewerage improvements. For some agencies enabling statutes stipulate that general obligation bonds shall mature in serial annual installments not to exceed 40 years, or some other period within the estimated useful life of the improvements to be financed. Enabling statutes may also regulate the rate at which bonds must mature to insure that too great a proportion of principal repayment is not deferred for later generations to pay. Deferment of principal repayment may be permitted during the early years, particularly during the construction period of a revenue producing facility.

With a revenue-supported general obligation bond, revenues from the enterprise are pledged toward payment of debt service. This limits the potential increase in the general tax rate. This type bond, sometimes called a double-barreled bond, has the advantages of a revenue bond, but maintains the low interest rate and ready marketability of a general obligation bond backed by the unlimited taxing power of the issuing agency.

Most public agencies can issue general obligation bonds only after receiving approval of two-thirds of the electors eligible to vote on the bond proposition.

Revenue Bonds. A straight revenue bond is one payable solely from charges made for services provided. Such bonds have no claim on money derived from taxes or special assessments. Their only security is the borrower's promise to operate the utility system in a way that will provide sufficient net revenue to meet the obligations of the bond issue. Most units of government in California can issue tax exempt municipal bonds under either the Revenue Bond Law of 1941 (Government Code 54300ff) or the Sewer Revenue Bond Law (Health and Safety Code 4950ff). Revenue bonds issued under the 1941 Law are more common.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenues pledged. Guarantees such as mortgages, liens, or full faith and credit provisions are not available in case of default. There are generally no legal limitations on the amount of revenue bonds that may be issued, but excessive offerings represent high investment risks and are unattractive to bond buyers. In rating revenue bonds, buyers look particularly at such things as the economic justification for the project, reputation of the borrower, methods of billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, policy of the borrower as to financial management, adequacy of reserve funds provided in bond proceedings, and the degree to which forecasts of net revenues are considered to be realistic.

To reassure bond purchasers on these matters a resolution of issuance, adopted by the governing board of the issuing agency, states terms and conditions intended to ensure that funds will be available to meet debt service. This resolution constitutes a contract between the issuer of the bonds and the purchaser. Because the payment of bond service is entirely contingent on future revenues, even very large and well established public agencies execute covenants such as these:

1. That the proceeds of sale of the bonds will be expended or used only for the purpose designated in the bond proceedings and resolution.

2. That the issuing party will set and maintain service rates at a level that will meet all operating and maintenance expenses and produce sufficient additional revenues to cover annual debt service by a factor ranging from 1.2 to 1.5, called debt service coverage. The coverage factor varies with risk and allows for cost overruns or revenue shortages.

3. That the funds pledged to annual debt service will be received and disbursed in a stated priority by a bank or trust company as trustee or fiscal agent.

4. That a bond reserve fund, usually in an amount of one year's debt service, will be established

either from the proceeds of the sale of bonds, or from the first revenues received, and be maintained during the life of the bonds.

5. That no additional revenue bonds will be issued on the security of the same revenues except under conditions involving a specified test of earnings in relation to debt service.

6. That so far as the issuing entity is able to do so, reasonable assurance will be made that revenues will not be endangered by competition, obsolescence, or other factors.

7. That the system producing the revenues will be maintained in good working order at all times.

8. That adequate insurance will be maintained by the issuer as a protection against major damage to the system and the resulting loss of revenues.

If the public agency is willing to execute such covenants, and the project is otherwise financially and economically sound, revenue bonds probably can be marketed quite successfully at an interest rate perhaps 1/4 percent higher than would be paid on general obligation bonds.

The amount of bonds issued would equal the project cost plus a reserve fund approximating one year's maximum annual debt service. The actual amount of the reserve fund would depend on the length of time over which the bonds are to be paid, the scheduling of maturity payments during the life of the bond issue, and the interest rate actually bid for the bonds.

The reserve fund does not necessarily constitute additional cost if the fund is not drawn upon to supplement revenues and earnings during the life of the bonds. It will be used to pay the last bonds outstanding and in the meantime it will earn interest to offset the cost of borrowing the reserve fund at the outset. The principal additional cost of revenue bonds is in the interest paid. On a $1,000,000 issue, an interest penalty of 1/4 percent will be $2,500 per year.

There are several reasons why revenue bonds are a popular financing vehicle. Some authorities and commissions have no other available means of raising capital. In other cases, constitutional or statutory debt limitations preclude the issuance of general obligation bonds and the proposed use of the funds will not permit issuance of special assessment bonds. The requirement for simple-majority voter approval, as compared with two-thirds majority approval for general obligation bond issues, may cause a public agency to turn to revenue issues.

Another advantage of revenue bonds is that they can be used to finance projects extending beyond normal municipal boundaries. Generally speaking, they may be supported by a pledge of revenues received from operations in any legitimate area of operation, whether within or without the geographical limits of the borrowing agency.

One difficulty in the marketing of revenue bonds to finance entirely new systems is that there is no record of earnings to be evaluated. In some instances water revenues may be pledged to a wastewater revenue bond issue, or wastewater revenues may be pledged to secure a water revenue issue. This "cross-pledging" is used to enable municipalities with an established water works earnings record to finance wastewater projects through revenue bonds, particularly in situations where a wastewater revenue system is not firmly established. Water revenues have had an exceptionally good record of punctual payment in full and, as a result, enjoy high esteem in the eyes of bond buyers. Cross-pledging may be permitted if the water and wastewater systems are combined for operation by a single agency or department, with pooling of revenues, operation and maintenance costs, and debt service.

Special Assessment Bonds. Special assessment bonds are commonly used for financing local collection sewers. Such bonds are issued only where it can be shown that a sewer or other improvement benefits only a limited geographical area. The assessment procedure attempts to apportion among benefited properties the costs of the improvement in proportion to direct or indirect benefits afforded by the improvement. The assessment is spread on the basis of various measures of relative benefit. In the case of sewers, front footage and property area are common measures.

A portion of the assessment generally relates to the sewer immediately abutting each property. The cost of larger trunks or mains which serve the entire assessment area may be spread over all properties, or may be financed by other means.

Most special assessment bonds are payable only from the receipts of special benefit assessments when collected, not from general tax revenues. The public agency issuing the bonds is obligated only to try to collect assessments and to apply them as promised to bond service. An unpaid assessment becomes a lien on the property assessed, superior to all other liens except liens for taxes or prior assessments with which it is on a parity.

Because assessment bonds represent a greater investment risk than bonds backed by the full faith and credit of the issuing agency, the bond market places a relatively higher interest rate on such bonds. The actual rate depends on many factors including cost of the project vs. assessed value of property, provisions for enforcing collections, the relative status of liens, and penalty provisions for unpaid assessments.

For sewer improvements two laws provide for creating property liens under assessment district proceedings. These are the Improvement Act of 1911 and the Municipal Improvement Act of 1913.

Two laws also provide for issuing bonds to represent unpaid assessment. These are the Improvement Act of 1911 and the Improvement Bond Act of 1915.

The 1913 Act permits collection of assessments and sale of bonds prior to the start of any construction. Bonds must be sold under either the 1911 Act or 1915 Act, since the 1913 Act does not provide for issuance of bonds under its own authority.

The 1911 Act permits sale of bonds only after construction has been completed. As with the 1913 Act Proceedings, bonds may be sold under either 1911 Act or 1915 Act provisions.

The major differences between 1911 Act bonds and 1915 Act bonds are these:

1. A 1911 Act bond represents an unpaid lien on a specific piece of property in a specific amount, while a 1915 Act bond is of even denomination, usually $1,000 and is protected by all unpaid liens on all properties.

2. With 1911 Act bonds, each property owner is solely responsible for payment of debt service on the bond on his property. With 1915 Act bonds the issuing agency has an obligation to levy a tax of not more than 10 cents per $100 of assessed valuation on all property in its boundaries to raise money to pay for property sold to the agency for delinquency, so there is less likelihood of default on the bonds.

Assessment bonds are a relatively expensive way to finance capital improvements, due to extensive legal and engineering services associated with assessment studies, special reports, public hearings, and creation of liens.

Pollution Control Financing Authority Bonds. In 1972 the California legislature, and California voters, authorized creation of the California Pollution Control Financing Authority. The statutory purpose of this authority is to provide private industry within the state an alternative method of financing pollution control facilities.

A project is eligible for authority financing if the appropriate state control agency certifies that the project is necessary to achieve compliance with applicable federal and state standards and is consistent with an approved regional, basin, or state plan for environmental protection. Also the authority must find that local public financing cannot reasonably be obtained.

Financing is achieved by authority issuance of an industrial revenue type of bond supported by a pledge of the full faith and credit of the authority. Also the authority may pledge all or any part of the revenues from any project or from any revenue-producing contract made by the authority with any individual, partnership, corporation, association, or other body, public or private. Such bonds do not constitute a debt or liability of the state. No project completed prior to creation of the authority may be financed by it.

The authority may issue pollution control bonds or other securities, payable solely from revenues of the authority, up to a limit of $200 million in new debt. The bonds may be serial or term bonds. The maximum maturity must not exceed 50 years. The bond sale may be public or private, at whatever interest rate or rates, and on whatever terms and conditions the authority's resolutions of issuance and sale provide. Bond covenants would be similar to those for other types of revenue bonds.

To achieve financing by this method the authority agrees by contract to finance the construction of a pollution control facility for a company. The company constructs the facility, subject to such supervision as the authority deems necessary. Title to the facility vests in the authority except the authority may enter into a contract which permits the company to purchase the project under an installment sales contract or other sales arrangements.

Tax-exempt revenue bonds provide industry with two major advantages over taxable financing:

1. A lower interest rate, perhaps one percent or more lower than conventional corporate bonds.

2. Tax benefits from retention of ownership if the lease on the pollution control facilities is drafted so that for federal income tax purposes it is treated as an installment sale.

A company, as legal owner of the facilities, can take depreciation and also deduct that portion of rent equivalent to interest on the bonds, instead of deducting only rent as a business expense. The company may also elect to take either the investment tax credit or rapid amortization on the facilities. In certain cases, where the depreciable life of the facility exceeds 15 years, the investment tax credit may be taken on a small portion of the capital cost even though rapid amortization also is elected.

Deferment of principal repayment on industrial revenue bonds affords industry another potential advantage. If during the time of such deferment a company takes depreciation and investment tax credit under an installment purchase arrangement, it can achieve a major cash flow benefit.

The Internal Revenue Service has approved this tax treatment in many private rulings provided that no person who is a substantial user of the project holds any of the bonds issued to finance the project.

Interest income from Pollution Control Financing Authority bonds is immune from state and local taxes in California except for bonds held by any substantial user of the pollution control facility.

Possible disadvantages of this type of financing from industry's viewpoint include:

1. A company may find it difficult to identify and segregate facilities eligible for pollution control financing from other process facilities, so that legal title to these facilities can be conveyed to the authority.

2. Complex legal steps, including an advance IRS ruling on some projects, lengthens the lead time for this type of financing compared with conventional corporate bonds.

3. If a pollution control program consists of many small projects at different plant locations, the saving in interest cost of tax-exempt over taxable debt may be offset by the additional expenses involved in many separate, small tax-exempt issues.

California industries, particularly in unincorporated areas, should begin to make substantial use of the advantages of tax-exempt financing afforded under the Pollution Control Financing Authority Act of 1972.

Promissory Note. Senate Bill 90, passed by the 1972 legislature, limits all borrowing powers of public agencies in California to those that have been duly authorized by the voters, or to those that can be exercised by the agency without increasing the agency's tax rate as it was levied in 1972/1973.

Many public agencies in California have specific authorization in their enabling statutes for short-term borrowing. Generally such limits stipulate a maximum principal amount as a percent of assessed valuation, a maximum term for the debt, and a maximum interest rate.

A county water district, for example, can issue promissory notes at an interest rate not exceeding 7 percent, for a maximum term of up to five years. For districts with assessed valuation in excess of $100 million, the maximum principal amount of these notes is one percent of assessed valuation for purposes other than flood control. For districts with assessed valuations of $100 million or less, the maximum principal amount for purposes other than flood control is 2 percent of assessed valuation or $1 million whichever is less. Such notes are general obligations of the district and, as such, fall within the limitations of Senate Bill 90 and Assembly Bill 2008 (Statutes of 1972, Chapter 1406 and Statutes of 1973, Chapter 358). Therefore, unless the district has unused taxing ability within the maximum rate set by SB90 and AB2008, see the discussion under Property Tax in the following section on Revenue Sources.

As a practical matter, however, Senate Bill 90 limits short-term borrowing for most agencies to that available through tax anticipation notes. These in turn are limited in principal amount to 85 percent of tax revenue anticipated during the year funds are borrowed. Such notes must be retired before the end of the fiscal year in which borrowed.

Federal and State Assistance. Chapter 10 discussed federal and state laws, regulations, and policies relative to grants for wastewater facilities. SWRCB Management Memorandum instructs basin contractors to assume that federal and state grants under the Clean Water Grant Program will be made available to the extent of 87.5 percent of the cost of current eligible facilities.

The financial analyses for this basin plan conform with this instruction. It is appropriate to note here, however, that the high assumed grant level makes the local share of the project cost very sensitive to relatively small changes in the grant percentage. If, for example, the federal/state grant is reduced to 75 percent, the local capital cost increases by 100 percent. Such a change in local capital cost could drastically alter financing feasibility from the local viewpoint.

Other programs provide additional funds for sewerage programs, most notably these:

1. Economic Development Administration grants may provide full funding for sewers and related public works in economically depressed areas.

The Farmers Home Administration administers a low interest loan program for sewerage and other improvements in rural areas. The State Water Resources Control Board is authorized to provide low interest loans for sewerage facilities under the Porter-Cologne Act.

Other miscellaneous federal programs provide grants and loans for planning and for demonstration projects as well as for public works construction.

The changing nature of these legislated programs and the fact that they may be authorized but not funded, makes their effect on construction financing unpredictable.

INSTITUTIONAL ARRANGEMENTS

Federal and state legislation has expressly identified the critical role of local governmental institutions in implementing any effective water quality control plan. Both the 1972 Federal Water Pollution Control Act Amendments and the State's Porter-Cologne Act establish broad guidelines for local governmental institutional arrangements through which the water quality control process operates.

The selection of the most appropriate form of a management agency and of local agencies will be discussed below following a general review of institutional requirements in federal and state legislation and also a discussion of the need for institutional change. The subsequent sections on selection of the most appropriate institutional forms for the Central Coastal Basin and inadequacies of present law will be based upon this analysis.

Institutional Requirements

As discussed in Chapter 10, the Federal Water Pollution Control Act Amendments of 1972 (PL92-500) and its regulations contained in the Federal Register (FR), the Porter-Cologne Water Quality Control Act (Water Code Div. 7, Sec. 1300ff) and the Clean Water Grant Program Regulations (CWGPR) define the function and relationships of areawide regional agencies in the planning and management of wastewater treatment.

The FWPCAA outlines a rational process of planning and implementation based on state, regional, and local needs, utilizing all levels of government. Primary responsibility for the prevention, reduction, and elimination of pollution is located at the state level (FWPCAA, Sec. 101(b), PCWQCA, Sec. 13000–. State agencies therefore are delegated the primary responsibility for comprehensive policy planning and coordination, and, according to federal law, must perform the central function of developing an annual strategy which sets the major objectives and priorities for the state water pollution control program (FR Vol. 38, 58, Sec. 130.40). The state plan, however, must be based on regional and local assessment of needs, and must contain provisions for implementation of recommended plans at the regional level.

Areawide wastewater management is thus a requirement of federal statute (FWPCAA, Sec. 208(c)(1)). The need for areawide management, however, is not merely a policy goal but is based upon the causes of present water quality control problems, as implied in the federal law, i.e., solutions to the numerous municipal and industrial control problems of today's urban-industrial concentrations require joint areawide implementation (FR Vol. 38, 58, Sec. 126.10) (FR 5/30/73). Therefore, federal legislation requires that affected general purpose units of government must have in operation a coordinated waste treatment management system (FR Vol. 38, 58, Sec. 126.10(c)(1), or show their intent through formally adopted resolutions to join together to plan and implement such a system for the area (FR Vol. 38, 58, Sec. 126.10(c)(1)). Legislation must be available, authorizing units of local government to enter into agreements for coordinated wastewater management (FR Vol. 38, 58, Sec. 126.10(d)).

The emphasis of the recent legislation is not only upon comprehensive areawide management, but also upon the integration and consolidation of waste treatment facilities to achieve better water quality management. The federal government consequently "shall encourage waste treatment management which results in integrating facilities" (FWPCAA Sec. 208(c)), while the State of California not only supports consolidation of wastewater treatment systems, but also gives priority in scheduling projects to those that will consolidate two or more existing systems (CWGPR Sec. 2104). The clear implication is that a single management agency can do the best job of water quality management.

Existing political boundaries are no longer the criterion for establishing a water quality management agency. Rather, communities may choose from a variety of institutional arrangements on the basis of which best serves their self-determined needs. The importance of considering new types of institutional arrangements is thus emphasized by the federal requirement that areawide plans contain alternatives for water treatment management (FWPCAA Sec. 201(g)(2)(A) and Sec. 208(b)(1).

Legislation, subsequently, allows a broad spectrum of choice of a management agency. The state may designate as a management agency any existing or newly created local, regional, or state agency or political subdivision for each planning area which meets certain functional requirements.

The SWRCB has adopted regulations relative to Areawide Waste Treatment Management (Administrative Code, Subchapter 18). These regulations define a "208 Planning Area" in accordance with requirements of the TWBCAA, establish procedures for determination of the need for such areas, and authorize the SWRCB to designate Section 208 Waste Treatment Management Agencies.

In brief, such areas must have a substantial water quality control problem. Appropriate local governmental agencies in the area must have in operation a coordinated waste treatment management system or must have joined together to develop and implement such a plan.

Institutional Change

If a single existing agency is unable to implement the recommended plan, one of four general situations exists: (1) no level of service, i.e., collection, treatment, disposal, is provided by any existing agency; (2) all levels of service are provided by several different local agencies; (3) two levels of service, treatment and disposal, are provided by some local agencies while collection is provided on a limited basis by other local agencies, i.e., portions of the service area have no collection; and (4) two levels of service, treatment and disposal, are provided by a regional agency while collection is provided on a limited basis by local agencies, i.e., portions of the service area have no collection. In each of the above situations a management agency must be selected at either the regional or local level. Where any level of service is lacking, an agency, either a local or regional management agency, local participating agency, or local contracting agency, must be created to provide the service. The management agency may be either; (1) a newly created local agency; (2) an existing regional agency; (3) a joint powers agency created by existing regional agencies; (4) a joint powers agency created by existing regional agencies and newly formed regional agencies; and (6) a joint powers agency created by both newly formed regional agencies and local agencies. Local agencies may either become party to the examples 4 and 6, above; or may contract with the management agency, i.e., become local contracting agencies, as in examples 2, 3 and 5 above. The selection process for both the form of the management agency and of the local participating or contracting agency is discussed below.

Selection of Management Agency

Figure 16-15 diagrams a decision process for selecting a management agency. This particular decision process represents a judgemental determination for a particular set of criteria. Under different circumstances, other criteria may be more appropriate and result in selection of a different institutional alternative. In selecting a management agency, the three areas of choice are: (1) whether existing agencies are adequate or whether new institutional forms need be implemented; (2) if new form is needed, whether the management agency should be a single local agency or a joint powers agency; and (3) if a joint powers agency, whether the joint powers agency should be a prime contractor or an umbrella agency. Each of these decisions depends on

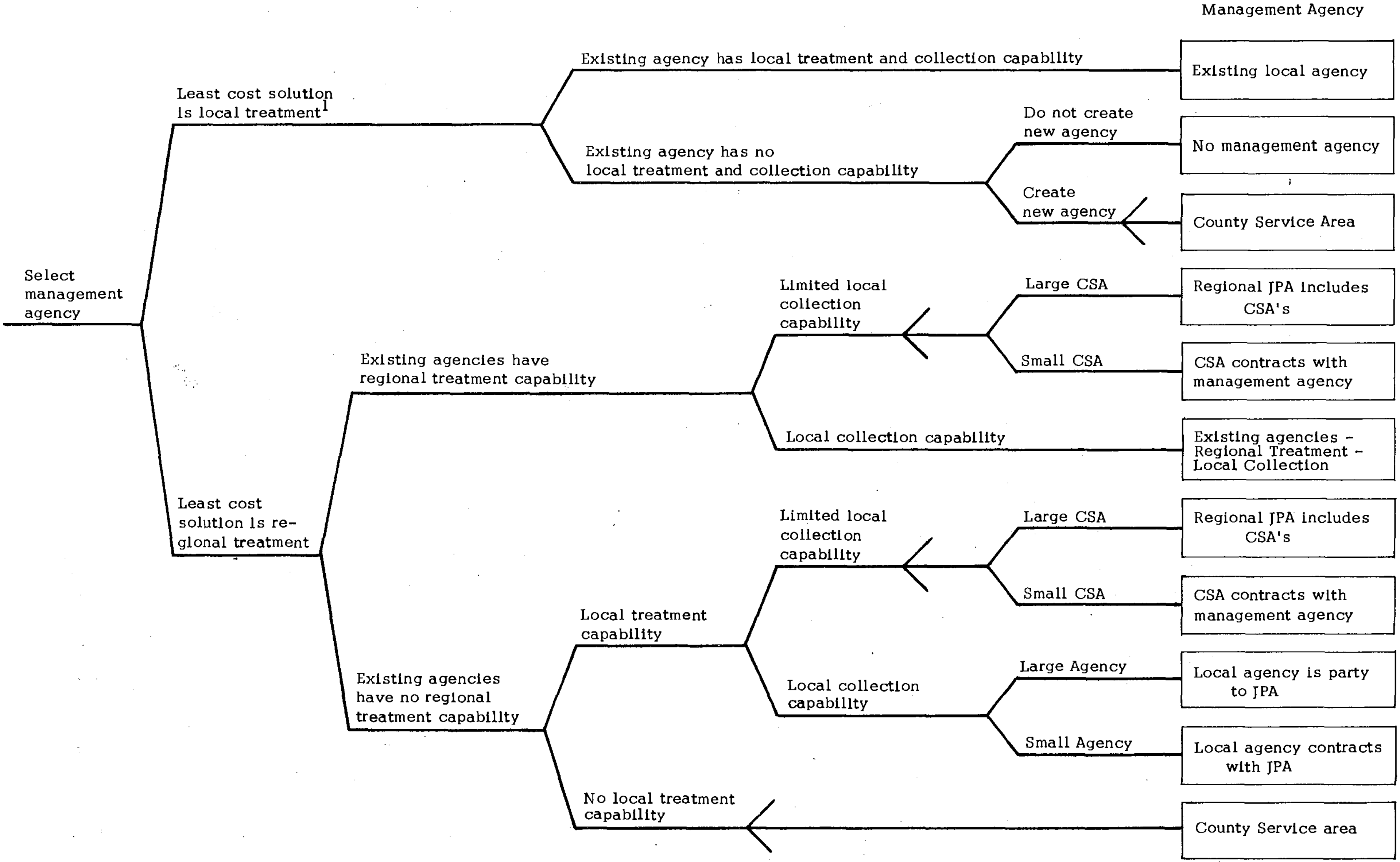


Fig. 16-15 Selection of Management Agency

whether the management plan has determined that the most feasible solution to an area's wastewater problem is regional or local treatment. The degree of treatment required and the geographical characteristics of the area will determine whether the most feasible solution to an area's wastewater problems requires regional or local treatment. Regional treatment is usually best suited to areas where communities are located in close geographic range and where high degrees of treatment must be maintained. The resulting joint use of outfall facilities, low interceptor costs, and general economies of scale substantially reduce the costs. Conversely, where local communities are widely separated, and high degrees of treatment are not required, interceptor costs are high, economies of scale do not result from regionalization. Consequently, local treatment is the most feasible solution. Once the wastewater management plan determines whether regional or local treatment is the most feasible or least cost solution to an area's water quality problems, analysis of wastewater collection, treatment, and disposal capabilities of existing agencies provides the basis for selecting the management agency. To simplify the discussion, disposal will be considered together with treatment.

Local Treatment is Most Feasible Solution

If local treatment has been determined as the least cost solution, it may be assumed that regional treatment facilities have not yet been constructed. If existing agencies have the capability for adequate treatment of wastewater at the local level, the capability for local collection also exists since wastewater treatment obviously requires prior collection. Consequently, under such circumstances, existing institutions are able to implement the management plan and may be designated to perform the management functions. However, if neither local nor regional treatment capability exists, local collection agencies cannot exist, but rather sewage and wastewater is handled by use of septic tanks. No management agency need be chosen if existing sewerage and wastewater service can meet federal and state standards. Otherwise new institutional forms must be created to provide adequate local collection and treatment.

Where new institutional forms must be created and local treatment is the most feasible solution, the choice of the form of the management agency is limited to a local agency. A joint powers agreement is excluded from consideration as it applies only to a regional system. The choice of the most appropriate local management agency is discussed below in "Selection Criteria for Local Agencies".

Regional Treatment is Most Feasible Solution

When the most feasible solution is regional treatment, the determining factor again in selection of the management agency is existing agency capability. If no agencies can provide treatment at either the regional or local level, a new agency must be formed. The basic requirement for this new entity is that it be able to provide both regional treatment and local collection. A County Service Area (CSA) not only meets that requirement, but has other characteristics which make it the best type of agency to select in this case. See the following section of "Selection Criteria for Local Agencies" for a detailed discussion of the CSA's advantages.

If local agencies have treatment and collection capability, they may implement regional treatment through a joint powers agreement. Each local collection agency may be a party to the agreement, or it may contract with the joint powers agency. When local collection capability is limited to only part of the region, a CSA should be formed for the unserved area. The CSA can then either become a party to the joint powers agreement or contract with the joint powers agency.

If existing agencies can provide regional treatment, the institutional solution depends upon local collection capability. When the whole region has local collection capability, there are no institutional changes. Local agencies will continue to provide local collection and the agency providing regional treatment will become the management agency. When local collection capability does not exist for a portion of the region, a CSA should be formed which will generally contract with the existing management agency. However, if the new CSA is large enough, a new joint powers agreement should be negotiated which includes the CSA.

The selection of the form of the joint powers agency depends upon the objectives of each of the parties to the agreement. However, certain criteria exist which may help guide agencies' selection. The prime contractor form appears preferable if there is an existing agency which is clearly predominant in size, capability, and area served; i.e., services the greatest portion of the service area, particularly where the treatment facility is within its boundaries. In addition, if one agency has greater taxing power to pay off bonded debt. all parties to the agreement may prefer to designate this agency as prime contractor. An umbrella agency appears preferable, however, if all parties to the agreement are fairly equal in size, capability, and area served. If each agency desires an equal voice in the management of the agency, the governing board form of the umbrella agency will provide this representation. Also, if no existing facilities will adequately serve the purposes of the recommended plan, nor are existing available personnel able to carry out the required tasks, the creation of an entirely new and separate agency delegated the exclusive responsibility for construction, administration, and operation and maintenance may prove more effective. All parties, however, must agree to the form which best serves their needs.

Selection Criteria for Local Agencies

Figure 16-16 diagrams a decision process for selecting the most appropriate local management, participating, or contracting agency. In this example the objective is to determine which of the agencies with authority over wastewater can best provide collection service to unincorporated areas.

There are various criteria to evaluate the various special purpose agencies. In the decision process therefore, a positive and negative value judgment is placed on each selection category. For example, in the category of financing powers, broad financing powers is a positive value and limited financing powers is a negative value in the selection process. Characteristics such as debt limit which limits the agency's ability to achieve broad financing powers, determine an agency's ranking in relation to the other institutional forms. In Figure 16-16 this process is followed for each category, with each agency ranked accordingly.

Functional Authority

Range: Broad ability to provide services (positive value) — limited ability to provide services (negative value).

The ability to provide a variety of services is viewed as a positive objective. The more varied the functional scope of the agency, the more able it is to serve as a management agency. Multiple service levels can provide cost reductions and serve community needs on a comprehensive basis. Agencies with ability to provide maximum service consequently rate highest ranking, while any functional limitations lower the rankings.

Area Served

Range: Able to serve broad geographic area (positive value) - geographic area limited (negative value).

Extent of service area is an important factor in evaluating the existing agencies ability to carry out the wastewater treatment management plans. The ability to serve a broad geographic territory proves of positive benefit in providing a broader tax base, lowering unit costs, and providing integrated service. Institutional forms limited by statutory restrictions, such as "must include existing public agencies", subsequently receive a lower ranking.

Financing Powers

Range: Broad financing powers (positive value) - limited financing powers (negative value).

The critical concern in this category is to determine the agency's flexibility in providing revenue for construction, operation, and maintenance of facilities. Financial flexibility enables an agency to undertake needed projects and to continue a long-term program. A range of options in financing sources reduces the cost of capital, benefiting both the institution and user. Broad financing powers is therefore defined as the ability to levy taxes, rates, and charges, and to incur debt without restrictive statutory limits. Agencies are ranked accordingly.

Governing Board

Range: Autonomous governing board (positive value) - shared governing board (negative value).

As the decision-making body of the agency, the governing board is critical to the functioning of the agency. An autonomous governing board is given a positive value. A shared governing board will necessarily devote less time and effort to the problems of each agency and it may tend to be less accountable to those whom it represents. The method by which members are chosen therefore reflects the agency's accountability to its constituents and its ability to define and serve the needs of the community. Agencies with autonomous, elected boards are given preference and ranked at a higher level because of increased functional

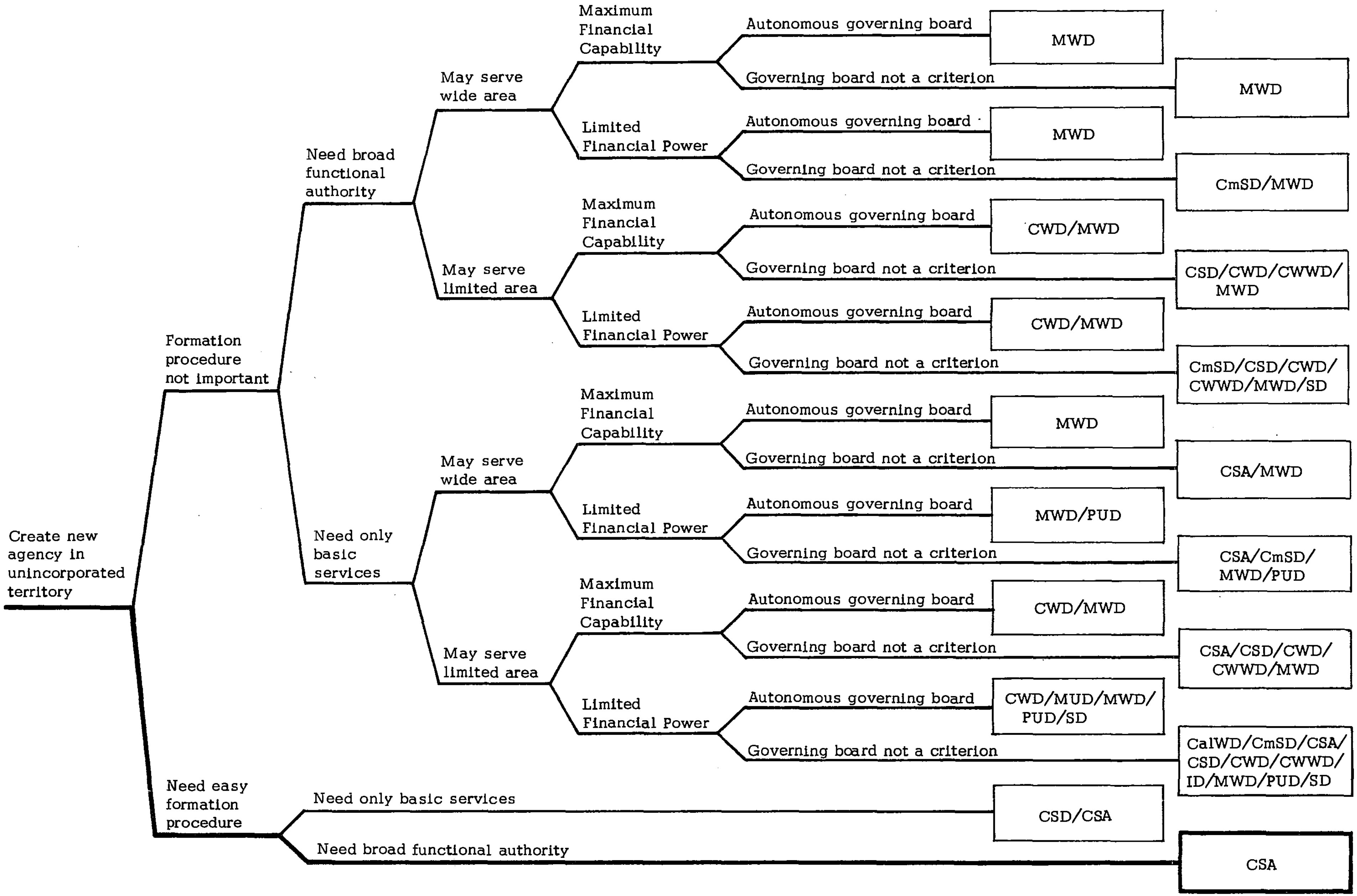


Fig. 16-16 Creation of Wastewater Agency

capability and a more representative form of government.

Formation

Range: Easily formed (positive value) - difficult to form (negative value).

Formation procedure is a critical factor in agency selection when service agencies do not exist or when existing agencies cannot provide adequate service. Positive value is placed on ease of formation as this represents the agency's responsiveness to changing environmental conditions and community need for service. Rapid and simple formation facilitates implementation of the management plans. Institutions which do not require lengthy formation proceedings such as petitions, extended hearings, and elections, but may be formed simply and quickly when there is no protest, such as by resolution of a County Board of Supervisors, are given a higher ranking.

The decision tree in Figure 16-16 places each of the criteria in a priority order. As a decision is made as to whether a criterion is a significant factor of choice, certain institutions are eliminated until the agency or agencies which best meet the needs of a particular situation are determined. The priority order of the criterion is an arbitrary judgment which reflects the importance of each in the mind of the decision maker. The decision tree therefore is only a model of the decision process and may be altered to reflect the preferences of the decision maker.

In this model, the goal is to choose the most appropriate agency to serve an unincorporated territory. One decision has thus been made, i.e., all institutions which cannot include unincorporated territory, which must include incorporated territory, or which have other limiting territorial requirements, are eliminated. Of the local agencies listed in Chapter 16 a CWD, Comm. SD, CSD, CSA, CWWD, MWD, PUB, MID, MUD, and SD remain under consideration. If the objective is to select a local management agency, the agency must be able to provide all three levels of service.

Formation procedure has been determined arbitrarily as the first criteria for consideration. If ease of formation is significant to the decision maker, a county service area and county sanitation district rank higher than all other agencies because both may be formed by the resolution of a Board of Supervisors, without an election, as long as no substantial protests are filed. The comparative ease of requiring a formation election for a county sanitation district, due to its statutory definition of "protest", gives a slightly greater weighting of preference to a county service area. In this case, the decision maker's second order selection criterion, functional authority, also points to a county service area due to its ability to provide an almost unlimited range of services. If formation procedure is not a critical factor in the choice of the local agency, another criteria is selected for consideration. In this case again, functional authority is arbitrarily selected. In most municipal cases sewerage function will be required; however, some unsewered areas may require a septic tank management district. The decision process thus continues until an agency is selected which is suited to meet the needs of a particular situation.

Implementation Schedule

Some changes in current institutional and governmental structures will be necessary to implement many of the features of the plan. As each of the presently unsewered areas in the basin begins to plan for the construction of a sewerage system, it will have to consider the establishment of some type of agency or entity capable of constructing, operating, and maintaining the resulting system. Similarly, as existing sewering agencies begin to move toward consolidation of treatment and disposal facilities, they will have to create the legal means of handling the resulting installations. The construction of wastewater reclamation projects may also be outside of the authority of existing agencies and they may be forced to accept new responsibilities or to contract with another entity to handle the project. In other cases, no institutional or governmental changes will be necessary.

Creation of new districts and formulation of new joint exercise of powers agreements are the most pressing institutional changes required for implementation of the recommended plan. Where either of these actions is necessary, the responsible local entities should proceed as one. This is a local prerogative and process that cannot be staged or dictated. A management agency must be created or designated, however, before it can begin to plan at the project level and to negotiate service contracts with the other participating agencies and local contracting agencies. The timetable for implementing institutional change is listed in Table 16-40.

Financing

Subchapter 18 to Chapter 3, Title 23, of the California Administrative Code provides criteria and procedures for designation of Section 208 planning and management agencies for water quality problem areas. The need for, and role of, such agencies are defined in Section 208 of the 1972 Federal Water Pollution Control Act Amendments.

In the September 1973 Project Report Guidelines (draft), published by the State Water Resources Control Board, there is the following typical project cycle under the Clean Water Grant Program.

Project Report Stage

This comprehensive stage requires an analysis of several interrelated factors, many of which are related to financial considerations.

Preliminary engineering design plan — This plan establishes service area boundaries, tentatively designates a construction site and rights of way, and sets cost estimates for the project.

Financing plan — This plan presents financial data, project revenues and expenses, suggests rates and charges including tax rates, estimates the amount and type of bonds to be issued in order to finance the project, and presents a revenue program summary for the state. It also projects cash flow during the construction period. If the project is for a regional system, the management agency during this period will negotiate with the other participating agencies and local contracting agencies to arrive at an acceptable way of sharing revenues, costs, and capacity in ways suggested by the financing plan.

Environmental Impact Report and Public Hearings — A manual dated July 1973, published by the State Water Resources Control Board, presents guidelines for the report and public participation.

Grant Application Stage

Bond authorization and final project design — The management agency will secure authorization for the bond issue through a local election, then complete the engineering design, and perfect state and federal grant applications. Meanwhile, the other agencies, when necessary, will begin to design, finance, and construct local collection systems. This process will continue through the other phases of the regional system's planning and construction will be completed when the local collection systems tie into the regional wastewater transportation system. This is followed by grant contract negotiations after which state and federal grant contracts are perfected.

Project Construction Stage

Advertise for construction bids, advertise bond sale — Upon authorization of bonds and completion of the final design, the management agency will solicit bids from construction contractors. During this period the management agency also will conduct its bond sale.

Sell bonds and award contract — The date for sale of bonds should be closely coordinated with award of the construction contract so that local funding is assured and construction can begin immediately.

Construction — Elements of the regional system should be coordinated with construction of the local collection system.

Follow-Up Stage

Operation and administration — Prior to and during the construction period the management agency, responsible for operation and maintenance of the transportation, treatment, and disposal system, will be developing a staff, implementing a rate ordinance, setting an annual budget, adopting necessary agreements with industry and others, holding regular business meetings, and administering the construction, preparatory to operation of the sewerage system. Participating agencies may be responsible for the operation and maintenance of their local collection function as well as treatment and disposal or reclamation. Figure 16-17 shows this sequence in a flow diagram.

INDUSTRIAL WASTEWATER MANAGEMENT ALTERNATIVES

Most of the industries within the Central Coastal Basin which do not discharge to municipal sewer systems are in compliance with current waste discharge requirements. Many of these industries utilize land containment and will be required to meet groundwater quality objectives contained in Chapter 4. Oil and gas production facilities are found throughout the basin; this industrial category is discussed further with other mining

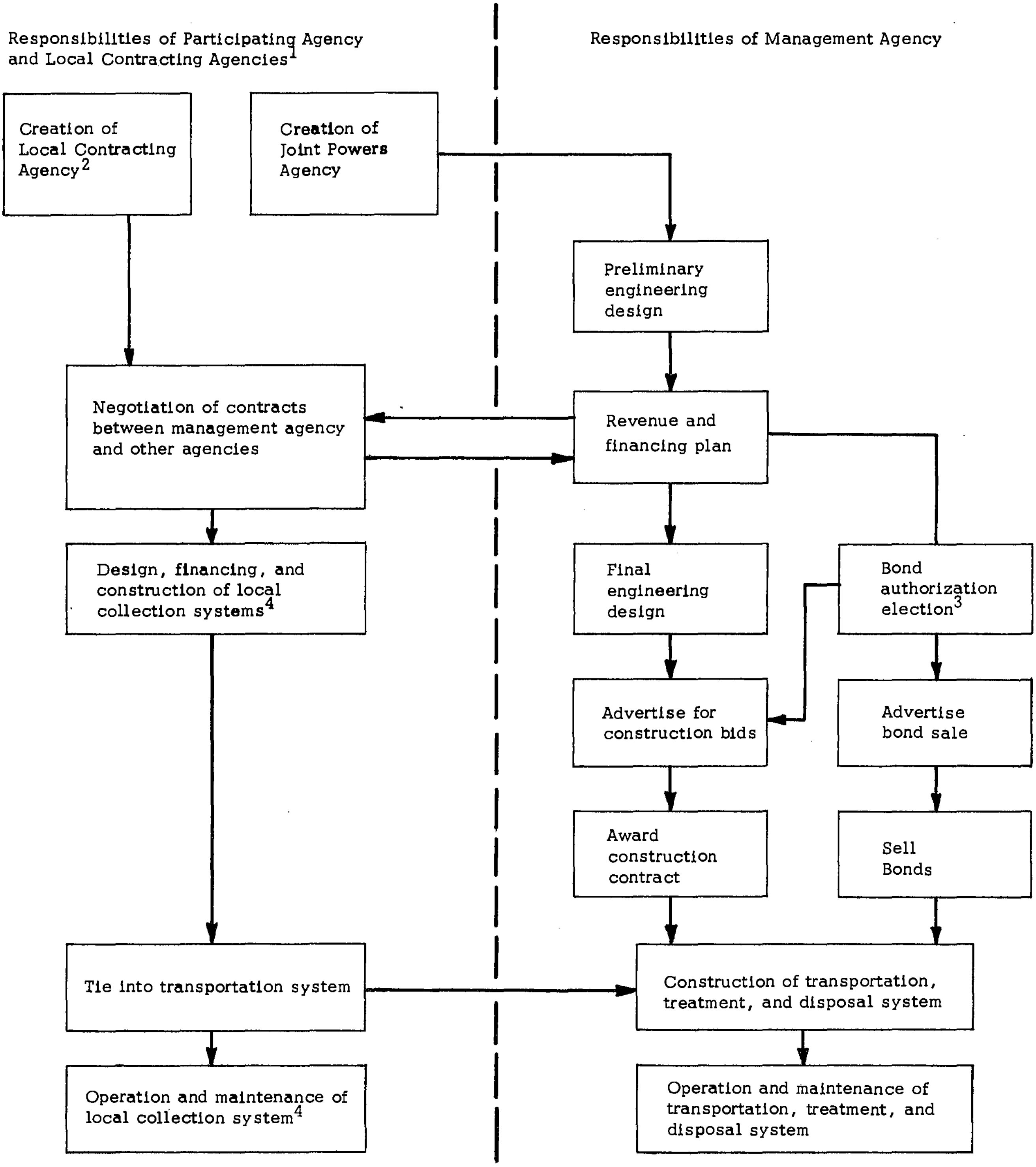
Table 16-40. Timetable for Implementing Institutional Change in the Central Coastal Basin

Formation of county service areas

Time	Action
T = Starting day	At least two members of the County Board of Supervisors file written requests for formation of county service area. By county, these would be: County — County service area Santa Clara — San Martin Santa Cruz — Bear Creek Estates; Monterey Bay Academy; Davenport; Big Basin State Park Monterey — Los Lomas-Hall/Fruitland; Toro Park; Toro Canyon; Gabrilan Acres; Bolsa Knolls; Oakhills; San Antonio Reservoir; Heritage Ranch; San Ardo San Luis Obispo — Santa Margarita Santa Barbara — Vandenberg Village; Mission Hills; New Cuyama; Nipomo
T + 40	County Boards of Supervisors adopt resolution of intention to establish county service areas. For each CSA, the resolution must: (1) State name of CSA (2) Describe boundaries (3) Declare the type(s) of services to be provided (4) Fix a time and place for public hearing or establishment of CSA Resolutions published in newspapers of general circulation.
T + 70 to + 100	Public hearing held by boards at which time protests received.
T + 130	Hearing may continue. Unless more than 50 percent of registered voters or owners of one half or more of value of real property protest, boards may adopt resolution to form CSA. Otherwise, board must abandon resolution.
T + 190	If 10 percent of registered voters protest adoption of resolution, resolution suspended. Board calls election. CSA formed upon approval of majority of voters.
T + 190	If 10 percent of registered voters do not protest, CSA formed.

Formation of joint powers agencies

Time	Action
T = Starting day	Joint powers agencies formed with prime contractor agencies at: City of Hollister City of Watsonville City of Paso Robles City of Lompoc
T + 190	Joint powers agencies contract with newly formed CSA's: Joint powers agency — County service area City of Gilroy — San Martin City of Santa Cruz — Bear Creek Estates City of Watsonville — Monterey Bay Academy; Los Lomas-Hall/Fruitland Monterey Bay Water Pollution Control Agency — Toro Park; Toro Canyon; Gabrilan Acres; Bolsa Knolls; Oakhills



1 - Necessary only for regional wastewater system.
2 - Necessary only where local collection agencies do not exist.
3 - Required only when previous authorization of bonds is insufficient.
4 - The management agency will have responsibility for collection where there is not a regional system.

Fig. 16-17 Responsibilities of Agencies for Implementation of Recommended Plan

operations. Other private dischargers, including hospitals, subdivisions and schools are included in this section where these are not sewered by public agencies. Industrial permits and requirements do not pertain to these dischargers; however requirements of Chapter 4 will be pertinent.

In general, the alternatives available to industrial dischargers are the following: (1) abandonment of the facility; (2) ocean discharge and compliance with the State Ocean Plan, the State Thermal Plan and Public Law 92-500; (3) containment of nonsaline and nontoxic wastes on land and (4) reinjection of oil and gas production brines. It is recommended that the Regional Board establish a timetable for either compliance with the water quality objectives of the plan or cessation of the discharge of industrial wastewater.

Specific effluent limitations are being promulgated for existing industrial waste discharges together with standards of performance and pretreatment standards for new sources pursuant to sections 304 (b), 306 (b), and 307 (b) of the Federal Water Pollution Control Act. Effluent limitations are being circulated for comment by the EPA. Waste source categories of particular interest in the basin which will be covered by those sections of the Federal Law include:

Meat product and rendering processing

Dairy product processing

Canned and preserved fruits and vegetables processing

Canned and preserved seafood processing

Cement manufacturing

Feedlots

Electroplating

Beet sugar processing

Petroleum production and refining

Steam electric power plants

Leather tanning and finishing

As procedures for establishing these guidelines and performance standards have been issued only to a minor segment of industry by the EPA, it appears inappropriate to attempt to anticipate regulations for these industrial discharge categories. Other industries will be covered in the NPDES program.

Industrial dischargers, their practices and recommended programs are described below. Where no specific recommendations are made present practices are considered acceptable; however industrial dischargers should review their individual situations in light of requirements described in Chapter 4 and prohibitions listed in Chapter 5. In most cases the industrial discharger alternatives will be limited by the standards of performance and pretreatment standards being developed by the EPA.

The Regional Water Quality Control Board should prepare schedules to effect compliance with appropriate policies such as the State Ocean Plan and with Public Law 92-500. Timetables should be established by mid-1975 and the various dischargers should effect compliance with the 1977 and 1983 effluent limits per PL 92-500.

Santa Cruz Coastal Sub-Basin

Campbell Soup Company's Pacific Mushroom Farm and the Ano Nuevo Farm Company in San Mateo County use septic tanks followed by an oxidation pond system to treat domestic sewage. Campbell Soup's Mushroom Farm sprays its industrial wastewater onto open land. Both facilities are meeting their current discharge requirements.

The Lone Star quarry near Santa Cruz currently discharges storm runoff to settling ponds which in turn discharge to the ocean. Lone Star is meeting current discharge requirements. Pacific Cement and Aggregate (PCA) near Newtown, a division of Lone Star Industries, discharges its wastes to settling ponds and the treated effluent is then returned to the PCA water system.

San Lorenzo River Sub-Basin

Kaiser Sand and Gravel and Santa Cruz Aggregate operate wastewater treatment facilities at their sand quarries along Bean Creek. They use settling ponds and percolate effluent back into the ground.

One industry, Lone Star Industries, maintains settling ponds to percolate washwater back into the ground. Individual disposal systems are used throughout the planning area to dispose of domestic waste flows.

The Santa Cruz water treatment plant presently discharges sludge from the filters and sedimentation basins to the San Lorenzo River during periods of high flow. This method of disposal will be eliminated when a sludge disposal line is constructed to the Santa Cruz municipal sewer system.

Sporup Sanitarium uses septic tanks with a design capacity of 2000 gallons per day for treatment of industrial sewage. Percolation ponds are used as a disposal method.

Aptos-Soquel Creeks Sub-Basin

The Bargetto's Winery provides screening for 400 gallons per day of wastewater which is discharged to Soquel Creek. The only industry connected to the municipal system in this sub-basin is West's Foods Mushroom Farm. Information concerning the specific characteristics of this discharge is not available.

Pajaro River Sub-Basin

The Mann and Rider Apple processing plants near Watsonville use stabilization ponds for wastewater treatment.

All industrial treatment facilities within this planning area are presently meeting the discharge requirements established by the Regional Board, although the Rider Apple Company has experienced periodic system failures.

Allied Foods currently discharges 1,000 gallons per day of wastewater to percolation ponds. This discharge currently meets discharge requirements established by the Regional Board.

Granite Rock Company maintains settling ponds for washwater. The settled washwater is discharged to the Pajaro River. Granite Rock is presently meeting discharge requirements established by the Regional Board.

Teledyne, Inc. near Hollister operates a treatment and disposal system for both domestic and industrial wastewater. Teledyne uses chemical-physical processes to remove toxic metals from their wastes. Treated effluent discharges to a small lake where it evaporates or percolates into the groundwater.

The Almaden Vineyards near Paicines operate a stabilization pond with a design capacity of 35,000 gallons per day. The present flow is 10,000 gallons per day. The facility also provides for land disposal of sludges. This facility presently meets discharge requirements established by the Regional Board.

Salinas River Sub-Basin

Elkhorn Farms Dairy, Moon Glow Dairy and Minhoto and Silva Dairy all provide stabilization ponds for treatment of wastewaters. Moon Glow and Minhoto and Silva also use their ponds for percolation and evaporation of wastewater and are presently meeting discharge requirements established by the Regional Board. Elkhorn Farms uses an irrigation disposal system in order to meet its discharge requirements. Sa Products Company and Pacific Gas and Electric Company discharge cooling water to Monterey Bay. Kaiser Aluminum and Chemical provides settling ponds for sludge wastes and discharges. Santa Cruz Cannery is under a cease and desist order for its discharge to Monterey Bay. General Fish Company, located in Moss Landing, discharges 1000 gallons per day.

About 15 industries are sewered by the City of Salinas industrial collection and treatment facilities. The wastewater is treated in ponds located near the Salinas River and the effluent is discharged to both land and the river. Those industries using the Salinas Industrial Sewer are listed in Table 16. In addition to these, 13 industries within the City of Salinas discharge waste to the Salinas Reclamation Canal. Industries using this canal include Union Ice Company, Monterey County Ice and Development Company, Growers Ice and Development Company, Let-Us-Pack, Frank Hibino Farms, Shippers Development Company, Liquid Ice Company, John Inglis Frozen Foods, Servi-Soft Company, Culligan Water Conditioning, Pure Grow and Spiegl Foods, Inc. Nuisance problems have occurred as a result of the discharges to the reclamation canal. Improvement of these discharges is being required.

Spreckels Sugar Company (which also serves the town of Spreckels) discharges to percolation ponds. Firestone Tire Company provides stabilization ponds and chemical treatment with discharge to percolation ponds. All of these facilities are currently in compliance with discharge requirements established by the Regional Board.

The B & P Packing Company near Soledad operates a stabilization-percolation pond system for the treatment and disposal of 15,000 gallons per day. The construction of a collection system in the South Soledad area will enable B & P to discharge its waste to the City of Soledad for treatment and disposal.

Gonzales Potato, Henry E. Hoffman Company and Valley Potato Company in the Gonzales-Chualar area all provide biological stabilization, chemical treatment and disinfection prior to discharging wastewater to percolation ponds. Fat City Cattle Company, Salinas Valley Feed Yard and United Feed Yards all provide stabilization ponds for treatment of wastewater with evaporation-percolation ponds for effluent disposal. All dischargers either meet existing discharge requirements or have planned additions to their treatment facilities in order to comply with discharge requirements established by the Regional Board.

Maggio Vegetable Company screens waste flows which are then discharged to San Lorenzo Creek. King City Oil Field is eliminating discharges to percolation ponds and going to deep well injection as has Burreson Petro-Gas.

Buena Vista and New Klau mining companies provide settling ponds and chemical treatment of wastewaters with land disposal. These facilities are not meeting discharge requirements.

Carmel River Sub-Basin

The industrial discharger, Highlands Inn, Inc., maintains two septic tanks followed by filter boxes and chlorination facilities to treat the waste produced by this hotel-restaurant complex before discharging to the ocean through two outfall lines.

The California American Water Company disposes of filter backwash water by percolation in the upper Carmel Valley. This treatment facility meets existing discharge requirements. The Water Company also maintains a discharge at the iron removal facility in the lower Carmel Valley.

San Luis Obispo Coastal Sub-Basin

Morro Bay Power Plant. The Morro Bay Power Plant withdraws about 526 mgd of seawater from Morro Bay and about 30,000 gpd of freshwater from the Morro Creek groundwater basin. In addition, approximately 200,000 gallons of seawater are used periodically to pressure test and flush tanker-to-shore fuel oil lines prior to delivery of fuel oil.

The plant generates about 10,650 megawatt hours of electrical power per day. Wastes are generated by the following activities: cooling, cooling water chlorination, seawater evaporation, boiler water side cleaning, boiler fire side cleaning, fuel leakage and fuel line testing and flushing. The Pacific Gas and Electric Company discharges 340 mgd of cooling water from the Morro Bay Power Plant. The cooling water, which is predominately sea water, is discharged from a tunnel just north of Morro Rock.

Wastewater containing spilled oils is treated to remove the oil and is discharged intermittently at a rate of 500 gallons per minute (average 75 gpm) into the cooling water effluent stream. Boiler cleaning wastewater containing 5% hydrochloric acid and a decopperizing solution is discharged to the cooling water tunnel at a rate of 600 to 1,000 gallons per hour which provides dilution ratios of at least 1:12,000. Approximately 200,000 gallons of water is used to flush and pressure test tanker-to-shore oil lines prior to delivery of fuel oil. This water is disposed of in percolation ponds near the fuel oil storage tanks north of the power plant. The sanitary wastes from the plant are discharged to the City of Morro Bay sewerage system.

Pacific Gas and Electric Company has submitted a Thermal Effect Study to determine the effect of the discharge on the aquatic environment. The study was used by the Regional Board to determine the compliance of the discharge with the State Ocean Plan, the State Thermal Plan and PL 92-500.

Estero Bay Marine Terminal. The following alternatives should be investigated by the discharger and data on technical feasibility, cost and environmental impact provided the Regional Board in order that a reasonable management plan can be formulated:

1. Alternative treatment processes for the 0.25 mgd of tanker ballast to include estimates of effluent quality and mass emission.

2. Alternative disposal options which will comply with the State Ocean Plan and which will not endanger the water quality and beneficial uses of Morro Creek and its underlying groundwater basin.

3. A contingency plan for the cleanup of spilled fuel oil should be developed.

Morro Bay Sales Terminal. The following alternatives should be investigated by the discharger and data on technical feasibility, cost and environmental impact provided the RWQCB in order that a reasonable management plan can be formulated:

1. Quality and quantity of wastewaters from all waste producing activities. Data should be expressed in terms of the UMER, MER, concentration and percent removal during waste treatment of all significant waste constituents. The frequency-time-volume relationship should be identified for stormwater runoff.

2. Alternative treatment processes to include estimates of effluent quality and mass emission.

3. Alternative disposal options which will comply with the State Ocean Plan and which will not endanger the water quality and beneficial uses of Morro Creek and its underlying groundwater basin.

4. A contingency plan for the cleanup of spilled oil should be developed.

Diablo Canyon Nuclear Power Plant. Units 1 and 2 of the Diablo Canyon Nuclear Power Plant, owned by Pacific Gas and Electric Company, are now being constructed and will go into operation in the near future. The plant is located on the coast about 10 miles south of Morro Bay. Condenser cooling water will be taken from the ocean and discharged near the shore in Diablo Cove.

Units 1 and 2 of the Diablo Canyon Nuclear Power Plant will consist of two pressurized water nuclear reactor units, each of which will require about 1,250 mgd of condenser cooling water. The cooling water will be withdrawn from and discharged to the Pacific Ocean. In addition to heat, the discharge will contain miscellaneous chemical wastes, septic tank effluent small quantites of oil and, on occasion, chlorine for slime and algae control and low level radioactive wastes. In addition, about 220,000 gpd of freshwater from local groundwater supplies will be needed.

The discharge from Units 1 and 2 has been specifically exempted from the effluent requirements of the State Thermal Plan. The discharge has not been exempted from the State Ocean Plan or from Public Law 92-500, however, and it must comply with waste discharge requirements adopted by the Regional Board on October 17, 1969. Units 3 and 4 which may be constructed during the time frame of this study will not be exempted from the effluent requirements of the State's Thermal Plan.

Cooling water volume is expected to be 2,500 mgd (1,250 mgd per unit) and its temperature will be 18°F above ambient during normal, continuous operation. Less than a few hours per month a periodic thermal treatment is provided to minimize the growth of marine organisms in the piping and heat exchanges. A residual chlorine concentration of 0.5 mg/l for periods of up to one hour twice a day at the condenser outlet will be used for slime and algae control.

The condenser cooling water will also be used to dilute and convey other plant wastes to the ocean. Concentrated sea water, produced in the production of distilled water for plant use, will be discharged into the cooling water flow. Various chemical wastes used in a pressurized water reactor nuclear power plant will be mixed in the effluent in quantities small enough so as not to significantly alter the pH or dissolved oxygen concentration of the cooling water discharge. The concentrations of any of these chemicals will be kept below 1 mg/l. The sanitary wastewater from 70 permanent employees will receive primary treatment in a septic tank and be discharged in the ground. Runoff from equipment areas can contain oil residues and will be processed in an air flotation separator. Separator effluent will have an oil concentration of less than 20 mg/l and the cooling water effluent will contain less than 0.01 mg/l of oil. Routine radioactive liquid wastes will first be stored in tanks to permit radioactive decay and then undergo treatment in evaporators, ion exchangers, and filters to remove radioisotopes from the wastewater. The low level liquid radioactive wastes produced in this way will be analyzed on a batch basis and discharged to the cooling water effluent if they comply with discharge limits.

Wastewater discharges from Units 1 and 2 are required to comply with waste discharge requirements adopted by the Regional Board on October 17, 1969. Units 1 and 2 were specifically exempted from water quality objectives for new discharges of elevated temperature wastes in the State Thermal Plan. Discharges from Units 3 and 4, however, are not exempted from requirements of the plan. A thorough study of the effect of the discharge on the aquatic environment will be necessary to ensure compliance with waste discharge requirements.

Union Oil Co. Avila Marine Terminal. The Union Oil Co. discharges treated sea water ballast received from tankers which load crude oil at Avila Wharf. In a technical report on its Avila Marine Terminal ocean discharge, submitted to the Regional Board on January 10, 1973, Union Oil noted that its discharge was not in compliance with several of the effluent quality requirements of the State Ocean Plan. Discharge of treated wastewater through an open-ended pipe to the ocean above the high tide level is also not in compliance with the objectives of the dilution requirements of the State Ocean Plan.

It is recommended that the Regional Board establish a timetable for compliance of the Union Oil Co. Avila Marine Terminal ocean discharge with the State Ocean Plan and that a contingency plan for the cleanup of spilled oil be developed by the discharger.

Ragged Point Inn. The Ragged Point Inn development consists of a motel, restaurant and service station located on State Highway 1 about one mile south of the San Luis Obispo-Monterey county line. Wastewaters are treated in a secondary treatment facility with a design capacity of 7,500 gpd and discharged to the Pacific Ocean by an outfall which terminates over a cliff in an area that is reportedly not accessible to the public. It is doubtful that the discharge meets the 100 to 1 dilution requirement of the State Ocean Plan.

Rancho Colina Mobile Home Park. The Rancho Colina Mobile Home Park is located on the north side of State Highway 41 approximately one mile east of the City of Morro Bay. The sewage treatment and disposal facilities are designed to treat 75,000 gallons per day from a population of 900 persons. Disposal of the plant effluent is by spray irrigation on land.

Robert Stark Development. The Robert Stark Development, in Baywood Park, consists of twelve residential units. Wastewater is disposed of by septic tank leach field with a daily capacity of 5,000 gallons. The ADWF produced by this small development was about 1,250 gpd in 1971.

Daisy Hill Mobile Home Park east of the town of Los Osos. The present wastewater treatment facilities will be enlarged to a design capacity of 42,600 gpd for 142 trailer spaces. The ADWF in 1970 was 25,800 gpd from 82 trailer spaces. Treatment will take place in a septic tank and a subsurface leaching will provide the means of disposal.

Cuesta Mobile Home Park. This mobile home park, located near the intersection of Broderson and Ramona Streets in Los Osos, has septic tanks and a leaching system for disposal of its wastewater. These facilities are designed to treat 22,700 gallons per day from 108 trailers. The ADWF in 1971 was about 20,400 gpd.

Fairway Manor Subdivision. The system serves a 23-lot subdivision located about five miles south of the City of San Luis Obispo at the southeast corner of the San Luis Obispo Country Club. The treatment facility is located about 400 feet east of the subdivision and has a design capacity of 8,050 gpd. Disposal of secondary effluent occurs by means of percolation and irrigation on land located about 1,400 feet east of the subdivision. In 1971, the ADWF through the system was 6,300 gpd.

Hidden Hills Mobilodge. This trailer park is located on the north side of Tank Farm Road near Edna Road south of the City of San Luis Obispo. Currently the system serves a population of about 60 persons residing in 30 trailers. In 1973 about 2,700 to 3,000 gallons per day of domestic wastewater were given secondary treatment in a Chicago Pump extended aeration facility prior to discharge to a tributary of San Luis Obispo Creek. The treatment facility has a design capacity of 8,000 gpd.

Avila Valley Camper Trailer Park. Design capacity of the trailer park's wastewater treatment facilities, located on the west side of Highway 101, is estimated to be 11,000 gpd.

Dunes Lakes Mobile Home Estates. A design flow of 50,000 gpd will be produced by this 150 lot mobile home park on the east side of Highway 1, approximatley four miles south of Arroyo Grande, south of Stratton Road. Subsurface leaching from a septic tank is the system's method of disposal.

San Luis Bay Properties. The San Luis Bay Properties system serves a resident population of about 200 plus the San Luis Bay Club restaurant and recreation facilities. The sewerage system consists of a main gravity collection system on the east side draining to the west bank of San Luis Obispo Creek and a main gravity collection system draining through a golf course in Harford Canyon. Each of these gravity collection systems empties into a wet well pumped through force mains to the wastewater treatment plant in Wild Cherry Canyon.

The wastewater treatment plant is a prefabricated packaged treatment plant utilizing the contact stabilization process as manufactured by Chicago Pump. Plans call for their treatment plant to be installed in 4 stages, as required by the growth of the development but to be designed so that ultimately it will be able to treat at least 250,000 gallons per day of domestic wastewater.

The initial treatment unit has a design capacity of 50,000 gpd. Effluent holding ponds of 500,000 gallon capacity (19 day ponds) have been constructed in Wild Cherry Canyon. These storage ponds are constructed so ultimately they can be enlarged to handle the ultimate design capacity of the treatment plant. An irrigation pumping system has been constructed to irrigate the upper portions of Wild Cherry Canyon. In 1970 an ADWF of 10,100 gallons per day was treated, disinfected and disposed of on land.

Santa Maria River Sub-Basin. In the Santa Maria Valley Region, industrial wastewaters are discharged by the Union Oil Company Santa Maria Refinery, by the Union Sugar Refinery, and by Sinton and Brown Company. Alternative wastewater management plans are outlined below for each discharger.

Union Oil Company — Santa Maria Refinery. The Union Oil Company, Santa Maria Refinery currently discharges about 400 gpm of industrial wastewater to the Pacific Ocean through an outfall which terminates at about 18 feet below mean sea level about 1,000 feet from shore. Effluent is discharged intermittently at a rate of 1,000 gpm through two 6-inch ports.

Wastewater from Union Oil Company's Santa Maria Refinery near Oso Flaco Lake consists of operating and process water, boiler blowdown water, cooling tower blowdown water, oil field brine, and stormwater drainage. Approximately 0.5 mgd is treated and discharged to the Pacific Ocean through a 1,000 foot ocean outfall located three quarters of a mile north of Oso Flaco Lake.

As noted in the Technical Report on their ocean discharge submitted to the Regional Board in April 1973, the refinery wastewater exceeds the effluent quality requirements of the State Ocean Plan for the following constituents: oil and grease (hexane extractables) turbidity, total chromium, cyanide, phenolic compounds, ammonia and toxicity. No data was provided in the report on the concentration of floating particulates or on the initial dilution provided by their ocean outfall. It is unlikely that the ocean outfall provides the 100 to 1 initial dilution required by the State Ocean Plan.

It is recommended that the following alternatives be investigated by the discharger and a Technical Report containing the findings of that study be submitted to the Regional Board:

1. Ocean discharge compliance with the State Ocean Plan, State Thermal Plan and PL92-500.

2. Land disposal in compliance with the groundwater quality objectives contained in Chapter 4. Particular concern should be given to the TDS, nitrogen, phenol and oil and grease content of the discharge.

Union Sugar Refinery. The Union Sugar Refinery disposes of 6,000 to 7,000 gpm of flume and process wastewaters to evaporation percolation ponds overlying the Santa Maria groundwater basin. Several reports by the State Department of Water Resources, the latest of which was published in 1969, indicate that the effect of the disposal of sugar-refining wastes has not been reflected in the groundwater quality of nearby wells. The relatively impervious nature of the bottom of the ponds is suggested as the reason why no groundwater quality degradation has occurred. The washing and transporting of beets produce wastewaters containing suspended and dissolved matter. These wastes are screened and disposed of in evaporation-percolation ponds on the property of the refinery. Wastewater from the pond system is recycled for cooling and beet transportation. Domestic wastewaters are disposed of in septic tanks. No change in current operations is necessary.

Sinton and Brown Company. The Sinton and Brown Company produces about 650 gpm of wastewater as a result of dehydration of sugar beet pulp from the Union Sugar Company. Currently the wastewater is mixed with well water and used to irrigate pasture. It is recommended that the discharger provide the following data to the Regional Board in order that a reasonable wastewater management plan can be formulated:

1. Quality and quantity of wastewaters from all waste producing activities.

2. Assurance that the waste discharge can be contained on the land disposal area at all times.

3. Assurance that the waste discharge will not violate the groundwater quality objectives contained in Chapter II. Special attention should be given to the nitrogen and TDS content of the discharge.

Airox, Incorporated. Airox, Incorporated, is located on the east side of the Lompoc-Casmalis Road, approximately 9.5 miles south of Santa Maria, and produces cement additives from natural deposits near Lompoc. Water used for washing exhaust air for dust control purposes is discharged to impervious holding ponds. The water is normally recycled without overflow or discharge to adjacent land. During storm periods Airox, Incorporated does periodically discharge to a drainage way. Apparently no water quality problems have been associated with this discharge and no change in operation is recommended.

Cuyama Valley Community Services, Incorporated. The community of New Cuyama is provided sewerage service by the Cuyama Valley Community Services, Inc. Wastewaters are collected from about 200 dwellings and a population of about 850 and conveyed to a wastewater treatment plant operated by the Foundation for Airborne Relief. This discharge is also described under municipal alternatives.

Black Lake Estates Mobile Home Subdivision. This subdivision is located on the north side of Juniper Street, approximately 3,000 feet east of Highway 101 in Nipomo. A septic tank subsurface leaching system is used which has a design capacity of 30,000 gpd produced from 120 lots.

Santa Ynez River Sub-Basin

In the Lompoc Valley Region, industrial wastewaters are discharged by Gefco, Incorporated and by Union Oil Company's Lompoc Oil Field. Alternative wastewater management plans are outlined below for each of the dischargers.

Grefco, Incorporated. Grefco, Incorporated discharges about 0.18 mgd of wastewater from dust control equipment to ponds adjacent to the Santa Ynez River without overflow. In order that a reasonable management plan for this discharger can be formulated, the following information should be provided the Regional Board:

1. Because the discharge is contained on land, the mass emission of those constituents which might threaten local groundwater quality objectives should be characterized.

2. Waste treatment unit processes and disposal facilities should be described in sufficient detail to allow an appraisal of their design and reliability. The ability of the disposal facilities to contain all wastewaters on land, even during wet weather, should be assessed.

Union Oil Lompoc Oil Field. The Union Oil wastewater discharge from the Lompoc Oil Field consists of 1.47 mgd of oil production wastewater. The wastewater is treated for oil removal and discharged to the Pacific Ocean near the mouth of the Santa Ynez River through a 700 foot long outfall. The outfall is anchored and usually floats about 3 feet below the surface. It is very unlikely that the initial dilution provided by the outfall meets the 100 to 1 initial dilution requirements of the State Ocean Plan. Data on effluent quality provided by Union Oil Company in a Technical Report on its ocean discharge dated January 11, 1973, indicate that concentrations of oil and grease and turbidity exceed the effluent requirements of the State Ocean Plan. No data were provided on the effluent concentrations of floating particulates, suspended solids, settleable solids, cyanide, phenolic compounds, and toxicity.

As was noted in Union Oil's Technical Report, alternatives available to the discharge include the following: (1) upgrade the wastewater treatment and disposal facilities to enable compliance with the State Ocean Plan: (2) injection of the wastewater into the oil-bearing formations and (3) abandonment of the Lompoc Oil Field.

Union Oil plans to pursue a program of wastewater injection and has requested that permission be granted to use the existing outfall to discharge treated wastewater during times of extreme emergency. The following alternatives should be investigated by the discharger and a Technical Report containing data on technical feasibility, cost and environmental impact provided the Regional Board in order that a reasonable management plan can be formulated:

1. Wastewater reinjection.

2. Compliance with the dilution and water quality objectives of the State Ocean Plan.

Park Water Company, Disposal Division. The community of Vandenberg village is served by the sewage treatment and disposal facilities of the Vandenberg Disposal Company. The community covers an area of 670 acres north of Lompoc. The wastewater flows are conveyed to the WTP through 8 to 12-inch trunk sewer lines; the trunk system contains one pumping station with a design capacity of 0.32 mgd pumping against a head of 250 feet.

The treatment plant, built in 1960 consists of two package units and has a design capacity of 0.52 mgd. A "clarigester" provides both primary sedimentation and digestion; while a biofilter unit is used for secondary treatment. Modifications to the plant had eliminated recirculation, resulting in poorer quality effluent. Increases in both treatment capacity and efficiency have occurred by recently initiating the recirculation of a portion of the filter underflow. Wastewater effluent is chlorinated and stored in a lagoon prior to ultimate disposal by spraying a hillside area. Sludge is presently removed from the digester compartment of the clarigester and discharged to sludge drying beds from which the dried sludge is removed and used for fertilizer. The ADWF for Vandenberg village was 0.40 mgd in 1971.

Current plans call for the abandonment of the Park Water Company WTP and the conveyance of those wastewaters to the improved and enlarged City of Lompoc WTP as part of the previously mentioned 1972-73 project.[8] Gravity trunk sewers and a pumping station and force main are a part of the proposed project.

Lompoc Utilities Services. Lompoc Utilities Services owns the wastewater treatment facilities for Mission Hills. The service area for the plant is 275 acres and is drained by Purisma Canyon. The upper treatment plant, located in Purisma Canyon, was originally designed to provide secondary treatment by means of primary sedimentation, separate sludge digestion, two-stage oxidation ponds and post-chlorination. At present, however, the upper treatment plant only utilizes a comminutor screen prior to the oxidation ponds.

The lower treatment plant is located adjacent to the Santa Ynez River. An influent lift station located at the lower plant has a design capacity of 0.5 mgd pumping against total head of 10 feet. This plant consists of two oxidation ponds of 14.23 acres. At each plant the wastewater is alternately aerated in one pond with a portable mechanical aerator, while the other pond is allowed to dry, the sludge removed and the surface scarified. The present facilities have a design capacity of 0.30 mgd. The ADWF to these facilities was 0.19 in 1971.

Current plans call for the abandonment of the Lompoc Utilities Services ponds and the conveyance of the area's wastewaters to the improved and enlarged City of Lompoc WTP as a part of the previously mentioned 1972-73 project.[8] A pumping station, force main and gravity sewer are a part of the proposed project.

Ray A. Kroc Ranch. The Kroc Ranch is located at Happy Canyon Road, several miles east of Santa Ynez. Wastewaters, estimated at 15,000 gallons per day at design capacity, are treated in a secondary treatment plant and disposed of in a subsurface leach field system. The disposal area is several hundred feet from any buildings and approximately 1,000 feet from a water supply well. The ADWF was 400 gpd in 1971.

Santa Barbara Coastal Sub-Basin

In the Santa Barbara coastal region, industrial wastewaters are discharged by Union Oil Company Point Conception, Phillips Oil Company Platform Harry, Getty Oil Company Gaviota Marine Terminal, Shell Oil Company Captain Field, Standard Oil Company Gaviota Gas Plant, Atlantic Richfield Oil Company Platform Holly, Atlantic Richfield Company South Elwood Field Treatment Facility, Signal Oil Company Elwood Field, Standard Oil Company Carpinteria, Sun Oil Company Platform Hill House, and Phillips Petroleum Company Tajiguas Shore Site Facility, Shell Oil Company Molino Gas Plant, Standard Oil Company Platform Hope, Standard Oil Company Platform Heidi, Standard Oil Company Platform Hilda, Standard Oil Company Platform Hazel, Mobil Oil Company Platform Hope, and Texaco Inc. Platform Helen. Alternative wastewater management plans are outlined below for each discharger.

Union Oil Company Point Conception Oil Field. Ocean disposal of brines has been replaced by deep well injection.

Phillips Petroleum Company Platform Harry. Phillips Petroleum Company discharges about 0.2 mgd of treated oil production wastewater to the Pacific Ocean about 1.5 miles offshore of Point Conception. The wastewater is separated from about 580 barrels per day of crude oil in an electric emulsion treatment facility. After separation from the crude oil in the electric emulsion treatment facility the oil content of the wastewater is reduced by passing it through a sedimentation tank and an air flotation unit. The treated wastewater is discharged by gravity through a pipe which terminates at about 90 feet below mean sea level. Phillips Petroleum Company has applied for a waste discharge permit from the Environmental Protection Agency but has apparently not submitted a technical report on their ocean discharge to the Regional Water Quality Control Board. Wastewater quality data submitted to the Environmental Protection Agency indicates that the concentrations of the following constituents are in excess of those stipulated in the State Ocean Plan: cadmium, chromium, copper, nickel, and ammonia. The same data indicate that the discharge is in compliance with the effluent requirements of the State Ocean Plan for oil and grease, lead, mercury, and zinc. The effluent concentrations of the following constituents are not available: floating particulates, turbidity, pH, arsenic, silver, cyanide, phenols, total identifiable chlorinated hydrocarbons and toxicity. Results of tests on the initial dilution of the wastewater with sea water and on the effect of the discharge on marine biota are also unavailable.

Alternatives available to the discharger include the following: (1) abandonment of the field; (2) continuation of the ocean discharge and compliance with the State Ocean Plan; and (3) initiation of a program of reinjection of the wastewater.

Getty Oil Company, Gaviota Marine Terminal. Getty Oil Company injects its brines into deep wells.

Standard Oil Company, Gaviota Gas Plant. Standard Oil Company discharges about 0.015 mgd of treated oil and gas production wastewater to the Pacific Ocean near the plant site. The discharger did not submit a Technical Report on its ocean discharge and no data are available concerning effluent quality, initial dilution and environmental impact of the waste discharge. The discharger has reported to the Regional Board that the discharge varies from 3,400 to 9,900 gpd and its oil content varies from 6.3 to 38 mg/l.

Atlantic Richfield Oil Company, Platform Holly. Atlantic Richfield Oil Company discharges about 0.06 mgd of treated oil and gas production wastewater to the Pacific Ocean through a 6-inch outfall pipe which terminates about 500 feet from shore at a depth of 11 feet. The wastewater is produced on Platform Holly mentioned previously. The discharger did not submit a Technical Report on its ocean discharge but has filed an application for a waste discharge permit with EPA.

Oil and water are treated with emulsion breaking chemicals and oil is separated from the brine in a heat-treated facility. Wastewater then passes through a flotation cell to remove residual oil and cool the effluent prior to discharge.

According to the data contained in the EPA discharge permit, the concentrations of the following constituents may exceed the effluent limitations of the State Ocean Plan: turbidity, total chromium, mercury, oil and grease and nickel. It is doubtful that the initial dilution provided by the ocean outfall will meet the 100 to 1 initial dilution requirements of the State Ocean Plan.

Signal Oil Company, Elwood Field. Signal Oil Company has recently replaced its ocean discharge with deep well injection.

Standard Oil Company, Carpinteria Plant. Standard Oil Company discharges about 0.48 mgd of treated oil and gas production wastewater produced on offshore platforms Hope, Heidi, Hilda and Hazel to the Pacific Ocean through a 400-foot long, 6-inch open-ended outfall pipe which terminates at a depth of 5 feet (MLLW). Oil is separated from the wastewater by sedimentation, heat treatment and flotation prior to discharge. Standard Oil submitted much data on its discharge to the Regional Board in a Technical Report dated April 2, 1973. According to that report the effluent concentrations of the following constituents exceed the effluent limitations of the State Ocean Plan: oil and grease, settleable solids, phenols and toxicity. Tests of the effluent carried out by an independent laboratory indicated that the concentrations of the following constituents also exceeded the limits of the State Ocean Plan: cadmium, chromium, lead, nickel and silver. Standard Oil took issue with the latter tests, however.

Standard Oil Company has proposed an implementation schedule for proposed improvements to the treatment process which are designed to bring the discharge in compliance with the State Ocean Plan.

Sun Oil Company, Platform Hillhouse. Sun Oil Company has recently replaced a discharge of about 0.1 mgd of treated oil and gas production wastewater to the Pacific Ocean with deep well injection.

Phillips Petroleum Company, Tajiguas Shore Site Facility. Phillips Petroleum Company discharges about 1.10 mgd of treated oil and gas production wastewater to the Pacific Ocean. The wastewater is separated from the hydrocarbons, settled and processed in a methanol recovery unit prior to discharge. The discharger did not submit a Technical Report on its ocean discharge but did submit an application to EPA for a waste discharge permit. According to the data submitted to EPA, the effluent concentration of total chromium and lead may exceed the requirements of the Plan.

Shell Oil Company, Molino Gas Plant. Shell Oil Company discharges about 0.005 mgd of treated oil and gas production wastewater to the Pacific Ocean via Canada de la Huerta. Wastewater is separated from oil by sedimentation and glycol is distilled from the wastewater prior to discharge. Shell Oil Company did not submit a Technical Report on its ocean discharge but did submit an application for a waste discharge permit to EPA. According to the limited data submitted to EPA, the effluent concentration of the following constituents exceeds the limits set in the State Ocean Plan: suspended solids, turbidity, total chromium, copper, lead, phenols and oil and grease.

Standard Oil Company Offshore Platforms. Standard Oil Company has four offshore platform, Hope, Heidi, Hilda and Hazel, which discharge about 10,000 gpd of treated washdown water, stormwater and drilling cuttings to the Pacific Ocean through a 16-inch outfall which terminates about 40 feet above the ocean floor. Oil and gas production brines are piped to the Carpinteria plant for treatment. The discharger did not submit a Technical Report on the discharges from the platforms and no data on effluent quality or initial dilution are available.

Rancho la Scherpa Presbyterian Conference Grounds. The Rancho la Scherpa Presbyterian Church Camp is located at Rancho la Scherpa in Refugio Pass. The wastewater produced by the camp is treated in a 9,000 gallon septic tank and discharged to three percolation-evaporation ponds on the southwest corner of the camp property. The ADWF produced at the camp was about 500 gpd in 1971.

Cate School Cate School, near Carpinteria, operates sewage treatment and disposal facilities with a capacity of 40,000 gallons per day designed for a population of 400 persons. The secondary effluent is disposed of by spray irrigation on a wooded hillside next to the treatment facilities. The ADWF in 1971 was about 14,000 gpd.

SOLID WASTE MANAGEMENT

The protection of water resources requires consideration of solid waste management practices. This section discusses present and future solid waste production, existing disposal practices and their effect on water quality, and proposed plans for future solid waste disposal within the study area. Solid wastes include (1) domestic waste-refuse, demolition wastes, sewage treatment plant sludge; (2) industrial wastes – special wastes which are a source of toxicity, mineralization, taste and odors (including semi-solid sludges and slurries); and (3) agricultural waste – nutrient sources (manures), pesticides and pesticide containers.

In the AMBAG area there are 45 authorized waste disposal sites most of which are sanitary landfill operations. These facilities are described in Chapter 16. There are two Class I sites within the AMBAG area. One Class I site is the Hollister, San Benito County site; however, this site only handles toxic wastes from San Benito County. The other is a modified Class I site near San Ardo which accepts only oil field wastes. Accordingly, toxic wastes are exported elsewhere or are placed in Class II sites within the AMBAG area in violation of regulations. Water quality problems related to waste disposal have been identified at nine sites and potential problems have been noted at four others.

The only existing solid waste management plan in the AMBAG area covers the Salinas Valley of Monterey County; however, a plan is being prepared for Santa Cruz County. The Salinas Valley plan recommends elimination of nine of ten existing disposal sites with consolidation of disposal activities at the existing Soledad site and development of a new site mid-way between Greenfield and King City. Implementation of this plan is recommended. Other areas within AMBAG should develop plans for solid waste management as required by State law and to comply with state requirements regulating waste disposal to land.

Projected solid waste loadings indicate the need for additional landfill areas in the southern portion of the basin. Some of the sites in the basin are no longer active; these include the Santa

Maria Airport and Guadalupe sites. Solid waste disposal information available for Santa Barbara County emphasized three landfills will be utilized for future refuse disposal including a proposed 20-acre landfill in the Ventucopa area near Highway 33 in the Cuyama valley, the Tajiguas Canyon site in the South Coastal Area and the Foxen Canyon site in the upper Santa Ynez Valley.

Institutional arrangements for solid waste management are confused since waste collection operations are both public and private and disposal sites are operated by various entities in Santa Barbara County. There are no Class I dump sites in San Luis Obispo County, so Class I waste materials must be hauled south to Tasmalia. Solid waste management planning should be given a high priority in San Luis Obispo County consistent with State Water Resources Control Board policies and in compliance with applicable State Health Department regulations. Administrative controls are needed at the county government level.

More information is needed on solid waste sites to permit more effective management. No systematic monitoring program is currently carried out to determine the effect of solid waste disposal sites on the quality of surface and groundwaters in the study area. It is recommended that specific provisions for carrying out monitoring programs be included in the discharge requirements for solid waste disposal operations. An adequate monitoring program should include collection of surface and groundwater samples upstream, adjacent or under, and downstream from sanitary landfills where appropriate.

Complete mineral analysis of surface and groundwater samples including determination of trace metals should be incorporated in the monitoring program. Bacteriological evaluation should be carried out for determination of coliform concentrations around all Class I and Class II disposal sites. Concentration of organic compounds, specifically those contained in the chemicals used for pest control purposes, should be determined in water samples obtained from areas adjacent to all Class I landfills.

It is recommended that discharge requirements, consistent with State policy, be established for all existing and proposed future land disposal sites in the basin.

VESSEL WASTE

Volumes and characteristics of recreational vessel wastes are summarized and projected in Chapter 5. The potential waste load will more than double by the year 2,000 due to an increase in both ownership per capita and an increase in population. Waste generated by commercial vessels is included in the industrial waste treatment facilities section.

Treatment Systems

Sanitary facilities vary with size, type and ownership of the vessels. The federal government, as directed by an executive order, is now installing large holding tanks on most U.S. military vessels. The tanks will store waste while the ship is within twelve miles of shore. Dockside, pumpout facilities will route the waste to a sewage treatment plant onshore. Outside the 12 mile zone, the ships will utilize direct discharge.

The sanitary facilities on commercial vessels, many of them foreign, differ greatly. There is no estimate available of their effectiveness in preventing waste discharges to the coastal waters on the south Central Coastal Basin.

The type of watercraft which has engendered the most controversy in regard to waste discharge is small craft (under 65 ft. in length). These are generally pleasure crafts, their numbers are increasing rapidly. The type of facilities found upon the small craft are:

1. Direct discharge – waste is flushed directly into the water with no treatment

2. Holding tank – waste is stored in a tank, and must be emptied at a dock or marina by a pump

3. Chemical – waste is chlorinated, then the particles are made smaller (macerated) before flushing into the waters

3. Incinerator – waste is dried and then burned

4. Biological – bacterial processing of waste

5. Portable or auxiliary – the entire head can be removed from the boat

Regulations

State Health and Safety Code, Section 4425 prohibits a vessel with a toilet from operating upon the waters of any lake, reservoir, or freshwater impoundment of this state unless the toilet is designed so that no human sewage can be discharged in such waters. This code section does not apply to rivers, estuaries or saltwater areas of California.

State regulations for variable waters differ among the Regional Boards. Emphasis, however, is being placed on the installation of holding tanks and marina pumpout facilities. Health and Safety Code Sections 4430—4433 prohibit the discharge of sewage to navigable waters of the state from any vessel moored to a dock where public toilet facilities are available.

The California Assembly now has before it AB-2581 requiring marine sanitation devices, including holding tanks, plus the installation of pumpout facilities at marinas. Marinas may hook into municipal systems or install large holding tanks and dispose of the effluent at Class I dumps. The installation of approved marine sanitary devices will be a necessary prerequisite for the required vessel registration with the California Department of Motor Vehicles.

Section 312 of Federal Law 92-500 required the Environmental Protection Agency to promulgate marine sanitation device standards. The standards were published on June 23, 1972, to become effective for new vessels two years after the Coast Guard issues, for enforcement, regulations, consistent with the EPA standards, governing the design, construction, installation and operation of the marine sanitation devices.

The Coast Guard guidelines, as they now stand, will allow pass-through systems of present boats if the systems will reduce fecal coliform bacteria to no more than 1,000 parts per 100 milliliters and prevent the discharge of visible floating solids. Existing vessels with Coast Guard certified flow through devices will be allowed to retain such devices for their useful life. New vessels will be under a no discharge standard with the issuance of the final guidelines.

NONPOINT WASTEWATER MANAGEMENT ALTERNATIVES

Nonpoint wastewater management is not amenable to the same kind of facility plans described for point sources such as municipal and industrial wastes. Most of the nonpoint pollution problems are relatable to land use practices, these practices may be regulated but rarely is there an array of equally acceptable alternatives. For example regulation could cause improvement of practices often at increased cost or prohibition or near elimination of the activity causing pollution. Often a problem is seasonal or short term, such as erosion from construction sites or runoff from city streets; pollution from such cases as these can be minimized by increased regulation of land development and road construction techniques in the first case or by frequent street cleaning and litter and debris control in the second. Alternatives could be no construction and no urbanization, and some areas such extreme measures may indeed by appropriate; wilderness areas and activities around water supply reservoirs and in areas of special biological significance such as the channel islands are examples. A further discussion of long term pollution control strategies as applied to regulation of nonpoint discharges is contained in Chapter 5.

Land use planning is considered relevant here and true alternatives for nonpoint pollution control could be developed during the consideration of alternative land use plans. The carrying capacity of an area, sometimes termed environmental capacity, is a concept of ecology which is germane. Environmental sensitivity, in terms of all environmental characteristics, would be analyzed in determining land use policy; water quality would be one of the environmental sensitivity factors considered. Earlier in this report environmental resources and constraints were described on maps for the Monterey Bay, San Luis Obispo, Santa Maria and Santa Barbara coastal area; see Chapter 6. These factors included aquatic life and terrestial life resources as well as physical constraints of slope, soil and flood hazard, location of urban areas, archeological sites and recreational use areas. These considerations have been integrated into environmental sensitivity maps related to wastewater disposal effects on the environment; examples of environmental sensitivity maps are provided in Chapter 6 for the Monterey Bay and San Luis Obispo coastal area.

A rating of both terrestrial and aquatic habitats was attempted in order to identify areas of greater or lesser environmental sensitivity. As an initial step aquatic life resources, urban and recreational areas and archeological sites were identified according to their known habitats as illustrated on individual maps. Following identification of the natural habitats, the urbanized areas and more sensitive use areas, the physical constraints as related to factors such as soils slope and groundwater level were arrayed. Sensitivity of selected habitats, physical factors, and land and water uses could then be considered together.

The concept of evaluating and ranking zones of ecological sensitivity is applied graphically to determine a composite sensitivity of many environmental elements. This approach was originally used to evaluate alternative highway routes and is described by Ian McHarg in his book, **Design with Nature**, published in 1970. In essence, the method designates geographical areas where values in land, water or air are of concern; the geographical areas of concern with respect to each of the separate values are designated with differing textures of shading on separate transparent overlays, which are then superimposed to produce a composite map. Areas of greatest cost of sensitivity are darkest on the composite map, while areas with the least environmental or social cost are revealed by the lightest tone. In effect, the approach rates both terrestrial and marine areas in terms of their environmental sensitivity with respect to the construction and operation of a wastewater management scheme.

The groupings of environmental factors considered in the environment sensitivity evaluation are described further in order to provide a greater understanding of the kinds of data utilized. A synthesis of these data is provided in a geographical sense on the maps; a relative ranking in terms of environmental sensitivity is provided.

The approach of evaluating environmental sensitivity or land capability is a way to determine environmental carrying capacity, which must be known to properly determine long term effects of land use controls. Short term changes can be made by cosmetic treatment such as improved erosion control techniques in land development or better drainage control methods for feedlots, but long term effects of large populations in fragile areas will be to greatly increase total costs for maintaining these populations in these areas, whether the governing issues are water supply, air quality, land stability, transportation, utility service or aesthetic. Thus, the alternatives for nonpoint pollution sources must be tied to land use planning. Controls over practices will be helpful but are more cosmetic than cure. If an area urbanizes, there will be urban drainage with bacterial contamination, litter, hexane extractable matter, phenols, sediment, organic matter, nutrients, and for a time at least, heavy metals such as lead from automotive operations and pesticides from the home garden. If an area is intensively irrigated in this basin, there will be salt concentration and return of salts of groundwater where soils are porous and groundwater degradation may occur if natural recharge is insufficient to flush the salts from the basin. Where groundwater levels are pumped down below natural sills, conditions are favorable for degradation.

The need for land use planning has been emphasized in the State of California Environmental Goals and Policies Report prepared by the Governor's office. The Federal Council on Environmental Quality (CEQ) has recognized the problem of land use control and identified the many legal and institutional constraints which have so limited land use control.

Historically people in the United States have held that the Constitution gives every man the right to do whatever he wants with his land; actually this is a myth for there is no basis for this in the Constitution or in English law. The myth persists however, probably a result of a statement in the Magna Carta which stated "No free man shall be deprived . . . of his freehold . . . unless by the lawful judgement of his peers and the law of the land". Despite this, land has been severely regulated throughout English and American history. In colonial times farmers were required by law to plant food crops in a time when individual farm economics favored tobacco production for export, zoning constraints were passed limiting or forbidding certain business activities in cities, and property owners were required in the year 1700 to plant trees for shade along streets in Philadelphia. Property rights found their way into the Bill of Rights in the form of the Fifth Amendment which states that no person shall "be deprived of life, liberty or property without due process of law; nor shall private property be taken for public use without just compensation". However, nowhere does the Constitution state that a man can do anything he wishes with his own property. Concepts such as zoning and environmental protection are relatively recent in our history and court decisions having legal precedence have emphasized that if regulation of property is excessive it was the same as "taking" it and the owner must be compensated; this legal precedence can be traced to a 1922 Supreme Court decision by Justice Holmes.

The Council of Environmental Quality has advocated a dramatic overruling of Holmes's 1922 decision to help bring consistency to future court rulings. The CEQ has also advocated an English system of statutory standards for determining whether compensation must be paid a person affected by a land use regulation. What must be accomplished is a major legal change and a relevant basis for land use control which can give purpose to land use regulations. Too often land use regulation takes the form of sweeping prohibitions and moratoriums on land development because no one has taken the time to study the problem sufficiently to work out any reasonable compromise or alternatives which consider both the rights of individuals and the needs of the environment. The cry of "inverse condemnation" on the one hand and "ecology" on the other is often with angry voices; sensitive land use planning is needed to remove the passion and restore rationale to future actions.

Although environmentally sensitive land use planning and controls are essential to the regulation of nonpoint waste sources, there is direct benefit to be derived from improved practices. The following discussions are provided relative to practices and alternatives which can improve water quality; these are described under the headings of urban runoff management, agricultural wastewater management, individual disposal systems and construction, mining and logging activities. In some cases these discussions are repetitions of material in Chapter 5, in others the discussion provides supplemental details on practices for nonpoint wastewater management.

Urban Runoff Management

The effect of urban runoff on receiving water quality is a problem which has only recently come to be recognized. Most of the work up to the present has centered on characterizing urban runoff: concentrations of various constituents have been measured, attempts to relate these to such factors as land use type and rainfall intensity have been made, and studies concerning the amounts of these constituents present on street surfaces have been conducted. It appears that considerable quantities of contaminants, heavy metals in particular, may enter the receiving waters through urban runoff. The Federal Water Pollution Control Act Amendments of 1972 stress future "control of treatment of all point and nonpoint sources of pollution." Thus the federal government has concluded that nonpoint sources, such as urban runoff, are indeed deleterious to the aquatic environment and that measures should be taken to control such emissions. The following discussion is presented in accordance with this view.

There are four basic approaches to controlling pollution from urban runoff: (1) prevent contaminants from reaching urban land surfaces; (2) improve street cleaning and cleaning of other areas where contaminants may be present; (3) treat runoff prior to discharge to receiving waters, and (4) controls of land use and development. Which approach or combination of approaches is most effective or economical has not been studied extensively. Thus only the basic characteristics of each approach can be discussed. In addition to these direct approaches are measures to reduce the problem by measures to reduce the volume of runoff from urban areas.

Agricultural Wastewater Management

The degree of water quality degradation from agriculture depends upon the type and extent of water use and waste management practices. Some data are available on the mass emission or total pollution load, but this information must be applied and analyzed in light of local activity and actual practices. Any solution to, or reduction of, current agricultural waste loads will probably involve changes in practices which cannot be suggested if they are little understood. Some typical agricultural practices and their possible effects on water quality are discussed in the following paragrphs. Alternatives usually pertain to practices available unless major changes in land use are envisioned.

Irrigation Return Flows

A concentration of soluable salts is an unavoidable result of consumptive use of water by irrigated crops. Water is drawn off by evapotranspiration and the salts are concentrated in the return flows.

Without the removal of salts from the soil, salts accumulate in direct proportion to the salt content of the irrigation water and depth of water applied. Less than two feet of reasonably good quality irrigation water contains sufficient salt to change a one foot depth of a salt-free loam soil to a saline condition, in a few years time, if there is no leaching. Even with leaching, salts in the soil solution will usually be in the range of four to ten times the concentration of the irrigation water; hence, the solution draining from the soil profile is usually much higher in salt content than the water applied.

Groundwater in many areas of the Central Coastal Basin serves as both the supplier and the receiver of irrigation water. Thus, irrigation returns to the groundwater supply the amounts of salts withdrawn. Degradation in the normal sense does not occur. Pollutants are not added to the system, but as water is consumed by evapotranspiration the concentrated salt in the return water degrades the existing groundwater supply.

In the process of irrigating crops, water is applied to the soil by one of several methods, including flooder, furrow, sprinkler and drip irrigation. The effect of the method of application on quality and quantity of irrigation return flows has not been fully researched. Major emphasis has been on maximizing production by choosing the optimum method for a particular crop, topography, soil characteristic, availability of water, salt content of the water and salt content of the soil.

Flood Irrigation. The flooding method, most often used for pastures, alfalfa, and small grains, requires level land for a uniform spreading. A variation of this type is the border-strip or border-check method in which earthen checks provide additional lateral control, especially on slightly steeper slopes. The flooding method requires more water per area than other methods as the large surface is subjected to increased evaporation by wind and sun. Also, when flood irrigation is practiced over porous soils, large amounts of water may percolate below the root zone. Historically, a substantial amount of the grain, pasture and alfalfa in the basin, has been irrigated by the flooding method. Newer acreage on the higher slopes may utilize sprinkler systems which require the use of less water and no leveling. Growers have been converting to sprinkler systems where high water cost, high cost of labor, or water penetration problems have resulted in a demonstrated increase in economic return resulting from the use of sprinklers.

Furrow Irrigation. Furrow irrigation is widely used for the many types of row crops cultivated in the basin. The furrow method accounts for approximately sixty percent of irrigation in the Santa Maria Valley and a major share in other vegetable producing areas. With this method there is a tendency for salts to accumulate in the ridges, due to water movement from the furrow towards the ridges. Cultivators often plant on the side of the ridge to offset this adverse occurrence. The length of run (furrow), size of streams (in the furrow), slope of the land, and time of application are factors that govern the depth and uniformity of application. Long runs passing over different soil types often result in an inferior crop yield, saturation in some areas and possible salt buildup in others. Long runs on homogeneous soils will often produce deep percolation losses at the start of the run and an inadequate infiltration at the end. To compensate for this occurrence, irrigators may over irrigate, spilling water out the end of the runs. The net result is an over irrigation which will probably result in minimum concentrations in the return waters, but due to exposure to the sun, unnecessary evaporation will occur, resulting in a greater than necessary water loss and increased buildup of salts in the groundwater supply.

Sprinkler Irrigation. Irrigation by sprinkling is generally more costly than other methods and has been used extensively only in recent years. This method allows a close control of the depth of water applied and when properly used, results in uniform distribution and higher yields. It is often used in areas where the slope is too great for other methods, where water costs are high, or where soil or crop peculiarities suggest improved yields can be expected from sprinkler irrigation.

Sprinklers also provide frost control for the frost sensitive crops such as grapes. The sprinklers tend to increase the temperatures in the immediate area of application as water freezing is a heat releasing process. Also, the critical temperature for many flowers and fruit is 28°F and the water freezing on the frost susceptible area has an insulating effect.

Drip Irrigation. The drip method is the least common of the various irrigation methods. It has been used extensively in areas with arid climates such as Israel. Several variations exist but all methods employ a slow, moderate and constant application of water. Initially, the method appears to use less water due to a low evaporation loss. However, leaching with either winter rains or one of the previously mentioned methods is necessary with longterm use. Another adverse aspect, not immediately obvious, came to light in a University of California Agricultural Extension Service avocado test plot in Santa Barbara. In this case tree roots concentrated in the drip zone and thus did not develop a normal broad base system. Usually, the broad-based root systems which develop with conventional methods of irrigation can collect and utilize percolating rainwater during the late fall. Concentrated root systems associated with the drip irrigation method were not able to adsorb the percolating rainwater and these orchards had to be irrigated well into the winter.

Irrigation Management. The efficiency of irrigation depends not only upon the method used, but the degree of management as well. Over irrigation may reduce yields and increase water loss by evaporation. All too often, it is economically more feasible, on the short run, for the growers to undermanage irrigation. Spill over at the end of the rows cost less than an irrigation crew of adequate size to insure maximum management. In the long run, however, as the competition for and the cost of available water supplies increase, the true economics of the situation will become evident.

Poultry Waste

Poultry waste does not present a major source of water quality degradation in the Central Coastal Basin. Operations are large, compact and efficient. Because birds are very disease susceptible, it is important to remove all potential sources of pathogens. Thus, manure is mechanically collected and marketed to a manure distributor. Agriculturalists in the basin provide a ready market for the manure which is often custom blended with sludge and cattle manure.

There are significant poultry operations located in the basin. Rosemary Farms, east of Santa Maria, is typical except for its large size (375,000 chickens). Around 250,000 birds are in production. The operation is dry and somewhat clean. Manure is mechanically collected and removed each week. In 1972 an estimated 7,360 cubic yards of manure were produced. The washdown of incubation quarters may present a problem, but the infrequency of occurrence and small amount of potential contaminants do not appear to be a significant source of degradation.

Dairy Waste

Water quality problems from confined animals generally center on two parameters; nitrogen and salts. Cattle are prodigious producers of waste because of their large size and need to assimilate a substantial amount of food. In the loafing corrals waste production is increased as a result of heavy feedings. All cattle waste does not enter groundwater or surface streams. Some volatilizes as ammonia gas and some undergoes natural decomposition (denitrification, for example). Management practices and dairy layouts influence the amount of potential waste available.

Surface runoff problems occur at several dairies in the basin during prolonged periods of wet weather. Equipment used for cleaning the corrals, in many cases, cannot operate in the wet manure. Percolation rates are typically low due to the impermeable nature of the hoof-packed surface, but runoff may carry a substantial load of suspended manure. The problem is intensified if loafing corrals are located on steep topography and/or if they are located adjacent to surface streams. In most cases, however, groundwater reservoirs are the major recipient of the feedlot waste during wet weather. Surface runoff will often percolate before it reaches a surface stream. Runoff can concentrate in low lying areas near feedlots.

Due to the nutrient content and soil conditioning properties of manure, its removal and use as a fertilizer and soil conditioner is encouraged by the large acreage of vegetable crops in the basin. Operational problems are usually associated with the prolonged periods of wetness which hamper removal of the natural moisture. Once removed, the manure must be turned several times to be dried by the sun. Manure contractors usually utilize the drier material that requires less labor and the wetter manure may remain stockpiled up to a year or more at the dairy. Percolation of leachate occurs as well as surface runoff during the winter. Presently the contractors receive approximately $4.00 a ton for manure spread on the field. The raw product must be pulverized and uniformly spread which entails some mechanization and accounts for most of the cost.

The volume of manure produced by some of the small dairies is not great enough to contract disposal without cost to the dairy. Thus, most disposal is accomplished on-site. Some operations are integrated with vegetable production which creates a demand for the waste. Dairies without such an outlet face economic problems and those with inadequate crop acreage may tend to over-fertilize.

Manures added to irrigated lands for their nutrient and soil conditioning properties contribute to the soluble salt load of the drainage water and add to the nitrate that is available for leaching. Upwards of ten tons per acre have been used on crops in the basin. The amount of salt added will depend upon the solubility and it may range from 800 to 3,000 pounds. Nitrogen contained in manure and added to the soil is subject to the same reactions as is the nitrogen contained in commercial fertilizers. The reactions are (1) mineralization, (2) absorption by crops, (3) nitrification, (4) denitrification, and (5) leaching. Fresh waste may contain twice as much nitrogen as older manure, as the simple nitrogenous compounds hydrolyze rather quickly and escape to the atmosphere as ammonia.

A special consideration common to dairies and not to feedlots is the slurry disposal problem. An attempt is made to keep dairies clean and the cows are washed before they enter the milking stalls. Manure washed off from the cow while in the wash shed represents a point waste source. This slurry plus that contributed by the cows while in the milking stalls is collected and piped away. In the Santa Ana Region, for example, the average volume is 42 gallons per day for each milking cow. Disposal methods vary but they usually center around irrigation. Some dairies pump the effluent directly to crop or pasture while others dilute it in small reservoirs. With some systems it is utilized over the entire farm while with others it is concentrated in one area, usually pasture. Cases in which the slurry has been discharged to surface waters have been noted. The limited assimilative capacity of crops and pasture for such high strength wastes, plus the riparian location of some dairies and the absence of discharge requirements, further a recurrence of surface water discharge.

Feedlot Waste

Water quality problems contributed to by feedlots are similar to those associated with loafing corrals of dairies. Projected feedlot waste loads indicate that this is a significant waste source. The practice of concentrating beef animals to facilitate constant feeding and accelerated weight gains has been intensified in recent years. Feedlots are growing in size to take advantage of the economies of scale. Weaner calves are introduced to the grazing lands after the first winter rains renew the grass growth. As the range begins to fail with a decrease in precipitation and the warmer temperatures of spring, range animals are brought into the feedlots to be "finished off" prior to sale. In some cases other feeders are also brought in, principally out of state.

Dry but mild summer conditions favor weight gaining and the feedlots swell to their maximum capacity during this period. Cattle waste during the summers present little problem. Surface runoff is nonexistent and wastes are dehydrated. Proper removal and application to crops complements a well-managed program. A substantial amount of nitrogen is volatilized and if manure is applied at proper rate much nitrogen will be taken up by plants.

The amount of waste generated and contributed to the surface streams or groundwater will depend upon several factors such as housing, management, diet, storage, handling practices, topography, soil texture, precipitation, and percentage of cloud-free days. Surface water runoff is a problem during the wet winter period where feedlots are not located on flat ground. The prolonged wet season will produce high contact periods between runoff and manure. The runoff, in some cases, flows directly into surface streams and in others it flows to a localized sink where it becomes a concentrated source of degraded recharge water. Poorly located manure stockpiles may also be a source of surface water degradation.

Pollutants contributed to the surface waters differ significantly from those percolating into the groundwater. Soils act as a natural filter to remove some constituents but researchers have noted that in some cases high COD, suspended solids and BOD loads can be contributed to surface streams.

Crop Waste

Concern over plant residues usually center on two aspects; they are a source of smoke and other air pollutants when burned, and they can act as a reservoir of plant disease and other pests. Of these, their role as a disease vector is given the most attention. Little or no burning of crop residues takes place in the basin. Stalks and stems are plowed under and allowed to decompose. Crop diseases are controlled by crop rotation and pesticides. Pesticide problems are considered in the next section.

Chemical Wastes

Fertilizers can act as chemical wastes and the only significant fertilizer constituent that needs discussion is nitrogen. Other constituents are effectively removed from percolating waters by precipitation and adsorption processes, or they are not of major concern in a water quality control study. A separate consideration which is discussed later is pesticide containers.

The recovery of nitrogen in the harvested portions of crop plants is usually about one-half or less of the total nitrogen input, leaving a fairly large portion available for leaching as nitrate or for volatilization losses. Because of this inefficiency there is no doubt that nitrogen fertilizers contribute to nitrate in groundwaters; a question remains, however, as to how much.

The fertilizer nitrogen that goes in the soil-crop system is subjected to a number of complex biological conversions including incorporation into soil humus, which in turn is subject to decomposition and release of nitrogen into mineral forms. A simplified overview of the process is that all forms of fertilizer nitrogen, except those occurring in flooded soils, tend to be converted to the nitrate form. The sinks for the added nitrogen are (1) removal in harvested crops, (2) leaching in the drainage water, and (3) loss to the atmosphere by denitrification; i.e., conversion of nitrate to the gases N_2O or N_2. Changes in the organic nitrogen content of soils can represent a source of mineral nitrogen if there is a net loss of organic nitrogen or a sink for nitrogen if there is a net increase in organic nitrogen.

Nitrogen requirements for many of the vegetable crops grown along the coastal valleys are relatively high, and many favor the more porous sandy soils. To achieve top yields, cultivators usually apply excess amounts to overcome the high percolation of nitrate impairment to the groundwater. On the average, celery receives 290 pounds of nitrogen per acre, strawberries 145 pounds, and other crops about 90 pounds. The total annual nitrogen application for all crops is 350,000 pounds. Of this estimated total, about 200,000 pounds remain in the basin as a result of excess applied waters and unharvested root and plant systems. It was concluded that the major source of groundwater degradation in the lower Arroyo Grande Valley is the nitrogenous fertilizers applied in the intensive farming conducted in the area.

Pesticide containers must be disposed of in Class I sanitary land fills. Applications of pesticides in the basin is largely on a contract system. Pesticide companies return the containers to a stockpile and then deposit them in a Class I site as necessary. An alternative disposal method is to rinse the containers in the field of application and dispose of them in a Class II solid waste site.

Other Agricultural Waste Sources

Other agricultural animals that contribute waste loads are swine, horses and range cattle. Due to their sparseness or nature of these types of operations in the southern Central Coastal Basin, waste loads from these sources are minimal.

Horse populations are increasing in the basin. The Santa Ynez Valley is becoming a focal point for Arabian horse breeding and the suburban ranches complete with horses are growing in number. Horse ranches in general, however, do not present a significant problem. Horses are kept in paddocks for the most part and the manure is not concentrated. Barn yard manure does present a problem as it must be disposed of. In this respect disposal problems somewhat parallel those of the feedlot and dairy corrals.

Ranch horses can create an odor and fly nuisance if the manure is allowed to build up. Corrals located on a slope in close proximity to a stream may contribute surface water waste loads. County health departments regulate the minimum corral area needed to prevent fly and odor problems due to horses in suburban areas. Confinement of horses in a relatively small area, however, will often result in defoliation of the area, which increases erosion and the sedimentation yield.

Swine, sheep and turkey operations are present in such small numbers in the basin they do not merit special attention. Disposal problems generally parallel those of similar animals.

Individual Disposal Systems

Septic tank systems and other similar methods for liquid waste disposal are sometimes viewed as interim solutions in urbanizing areas yet may be required to function for many years. The reliability of these systems is highly variable depending on land and soil constraints as well as individual maintenance which is often haphazard and rarely controlled after initial installation and inspection by local agencies. The usual septic tank maintenance carried out by individuals operating septic tank systems is solids removal following some major failure of the system; usually failures that bring most rapid attention to the septic tank result in blocked plumbing and backup of sewage into the home. More common but less dramatic failure occurs when septic tank liquid effluent surfaces on the ground where nuisance odor and potential health hazards can result.

Past Regulation Problems

Past regulations of septic tank systems have been directed principally at their design and construction and have been tied with local agency building permit procedures. The standards for septic tank systems have been largely based on the U.S. Public Health Service Manual of Septic Tank Practice.

Because septic tank systems are often neglected after their construction, maintenance is rare except in cases of major failure. Some kind of followup procedure is necessary to insure home owners are providing maintenance of their system and are not ignoring symptoms of septic tank failure. Recognizing the need for followup procedures, some agencies have adopted strict ordinances governing septic tank systems which provide for biennial inspection and a permit procedure which, in effect, conditions operation of the disposal system. This procedure is designed to assure that the system is continuing to function properly and requires a report of inspection by an authorized inspector and proof of repairs or alterations to a system as well as proof of septic tank pumping by a licensed pumper when pumping is required by the inspector. The ordinance contains enforcement procedures giving the inspector the right of entry under specified procedures.

Corrective Actions for Existing Systems

Individual disposal systems can be regulated with relative ease when they are proposed for a particular site; regulations generally provide for good design and construction practices and permit systems as described above can be made a condition for building. A more troublesome problem is that presented by older existing septic tank systems where design and construction may have been less strictly controlled and where land development has intensified to an extent that percolation systems are too close together and there is no room left for construction of replacement leaching areas. Where this situation develops to an extent that public health hazards and nuisance conditions develop, the most effective remedy is usually a sewer system. Where soil conditions are favorable for percolation, problems may not be obvious but groundwater degradation is possible, particularly nitrate buildup. Sewer system planning should be emphasized in urbanizing areas served by septic tanks; a first step would be a monitoring system involving surface and groundwaters to determine whether problems were developing. Where septic tank systems in urbanized areas are not scheduled for replacement by sewers and where public health hazards are not documented, septic tank maintenance procedures are encouraged to lessen the probability that a few major failures may force sewering of an area which, properly maintained, could be retained on individual systems without compromising water quality. Often a few systems will fail in an area where more frequent septic tank pumping, corrections to plumbing or leach fields or in-home water conservation measures could correct these faulty systems. These kinds of improvements should be enforced by a local septic tank management district or by the county.

Where water use is high, the septic tank receives a greater hydraulic load and failure can occur due to washout of solids into percolation areas causing plugging of the infiltrative surface. In such cases, home dishwashers, garbage grinders, and washing machines could be eliminated; in some cases, excess wash water could be diverted to separate percolation areas by in-home plumbing changes. Water saving toilets, faucets, and shower heads are available to encourage low water use. Inverse water rates also encourage more frugal use of water.

Criteria for New Systems

New septic tank systems should generally be limited to new divisions of land having a minimum parcel size of one acre, except where soil and other physical constraints are particularly favorable. In these cases, parcel size should not be less than one half acre. Subdivisions based on parcel size less than one half acre should be sewered regardless of soil suitability; in some cases, sewers can be deferred until build out reaches an equivalent density; however, alternative parcels must be left vacant to separate percolation systems and provide for fail-safe areas for replacement leach fields until sewers are available. Where parcel area is between one and five acres, future subdivisions may be permitted to develop septic tank systems so long as physical constraints are met; generally areas developed on parcels larger than five acres will not be required to provide sewers.

Physical constraints are principally related to depth of water table, depth of soil, ground slope and presence of water courses. Depth to bedrock or other impervious material should be greater than eight feet and depth to groundwater should be greater than ten feet at all times during the year. Ground slope should not exceed 30 percent. Septic tanks and leaching systems shall not be planned for any area where it appears that the total discharge of leachate to the geological system under fully developed conditions will likely cause damage to public or private property, degrade groundwater or create a nuisance or public health hazard; interim use of septic tank systems may be permitted where alternate parcels are held in reserve until sewer systems are available.

A septic tank policy for California is being considered by the State Water Resources Control Board; this policy, if implemented, will supersede considerations contained in this basin plan. It is anticipated that permit procedures, areal limitations, and physical constraints will not differ in any substantial way from those described above.

Septage Disposal

Disposal of septage, the solid residues pumped from septic tanks, must be accomplished in an acceptable manner. In some areas disposal may be to either a class I or II dump site; in others, this material will be discharged to a municipal treatment facility where such discharges can be accommodated. Wastewater treatment facilities in areas where septic tanks are also prevalent should consider special pretreatment measures to insure septage discharge does not disrupt and compromise treatment in the plant. Some facilities may prohibit septage discharge; however, where no treatment facility is available to service septage, such service should be provided by municipal agencies. To insure reliability of treatment, chemical toilet wastes should not be accepted; these more toxic substances which may harm biological treatment processes should be contained in appropriate solid waste sites.

Septic Tank Management

Unsewered areas developed on small lots (less than one acre size) should be administered by local septic tank maintenance districts, preferably as established by County government. These special districts could be administered through existing local governments such as a County Water District, a Community Services District, or a County Service Area. In many cases, densely populated areas may be sewered in the near future; however, maintenance district programs could include initiation of sewerage facility planning tailored to community needs wherein some areas may need to be retained on septic tanks rather than overburden community financing by extensive sewering programs. Septic tank management district approaches have been recommended for the San Lorenzo Valley, Carmel Highlands, Shandon, Los Osos-Baywood, Nipomo, and unsewered areas of the community of Santa Ynez.

Recommended Program for Individual Treatment Systems

It is recommended that individual treatment systems be retained in several areas prior to the establishment of the fact that problems exist which can only be corrected by sewering. Areas which are presently unsewered and which should undertake studies to determine the necessity of constructing sewers include San Lorenzo Valley, Carmel Valley, Los Osos-Baywood Park, Nipomo and Santa Ynez. In other areas, such as Los Alamos and the subdivisions south of the City of San Luis Obispo, the Regional Board should monitor the rate of urban development to determine when such studies are needed.

These studies, which should be closely coordinated with the Regional Board, should identify the significance of present water quality problems and should formulate alternative wastewater management plans that will alleviate those problems. The studies should indicate whether complete sewering, partial sewering, sewering at some later date or no sewering is necessary. The results of such studies would be used as a basis for revisions of the Basin Plan.

The studies should encompass an investigation of measures which, if implemented, could solve or at least minimize immediate problems with existing systems. They include enforced septic tank maintenance and pumping schedules, corrections to plumbing or leach fields, and in-the-home water conservation measures.

The studies should identify the cost to the homeowner of providing a wastewater collection and treatment system. A cost-effectiveness analysis which considers the socio-economic impacts of alternative plans should be used to select the recommended plan. In some communities, the increased cost of wastewater collection may be an unbearable burden to retired homeowners on a fixed income.

Where nitrate problems are occurring in the groundwater supply of such communities, the use of bottled water should be considered as an interim measure pending determination of means to remove nitrogen from the community's water supply or wastewater.

Where new construction is occurring, the following physical constraints should be considered in determining the advisability of reliance on septic tanks: depth of water table, depth of soil, ground slope and presence of water sources. In general, current Regional Board planning policy is that new septic tank systems should be limited to developments with a minimum parcel size of 1 acre except where soil and other physical conditions are particularly favorable. SWRCB guidelines also state that sub-divisions based on parcel sizes less than one-half acre should be sewered regardless of other considerations. If these preliminary planning guidelines are enforced as SWRCB policy, the retention of septic tank systems in affected areas will have the effect of limiting growth.

In the Los Osos-Baywood Park area, engineering studies should be implemented to yield data on the characteristics of the groundwater basins which are believed to underlie the area. If septic tanks turn out to be the best option for Los Osos-Baywood, then they should be placed such that the waste fields leach into the groundwater basin containing the lowest quality water. If the findings of the engineering study indicate that degradation of groundwater quality will occur, then the construction of new septic tanks should be prohibited. It may be possible to identify septic tank management approaches to help maintain workable individual systems in unsewered areas.

The objective of this recommended study is to identify a wastewater management system that will avoid nitrate and TDS buildups in a groundwater basin of excellent quality and the prevention of public health hazards generated by the contamination of groundwaters. In other areas, where problems such as the surfacing of septic tank drainage and backup of sewage into individual homes are occurring, the scope of engineering studies should also include solving these problems.

The recommended plan calls for the phasing out of septic tanks and the sewering of all areas where serious problems can be documented and where projected future population densities warrant it. Engineering studies will be needed, in most cases, to determine the most cost-effective solution to the specific problems facing each area.

Construction, Mining, and Logging Activities

Construction, mining, and associated activities which may disturb or expose soil or otherwise increase susceptibility of land areas to erosion are difficult to regulate effectively. Construction or logging may often begin and end with no obvious impairment of stream quality; however, erosion or land slides the following winter may be directly related to earlier land disturbance or tree cutting. Mining and quarrying activities are generally longer in duration. Land sensitivity to erosion can be assessed before land disturbances are permitted; environmental constraints could be identified for use in screening construction or logging permits and could be a basis for adding special conditions to waste discharge requirements where applicable.

Construction

The building of roads and subdivisions often exposes the soil to sheet and gully erosion. Soil once held in place by natural vegetation, moves downslope with storm runoff. Large impervious surfaces such as highways concentrate the runoff in the peripheral, often devegetated area. Plants, no longer present, do not adsorb moisture through transpiration or anchor the soil with their root systems.

Sedimentation from soil erosion is a major pollutant of surface waters in California. Natural erosion and erosion from agricultural land, subdivisions, road construction, barren burnt over slopes, grazing, and stream banks are principal sources of sediment.

Man's activities have a greater relative influence upon sheet and gully erosion than upon slides and soil creep. Over half of this erosion is caused by man. Sheet erosion by itself is a minor factor; gullying is responsible for most of this type of erosion. Sedimentation damage includes reservoir silting and resultant loss of storage capacity, filling of navigation channels, smothering of bottom dwelling organisms, turbidity which affects fisheries, aesthetics, and recreational activities. Siltation often results in the formation of channel sandbars and shoals which can obstruct flows and cause flooding. As a result of siltation, dredging with its potential adverse effects on water quality is often necessary. Unless otherwise noted, the material for this discussion came from the Division of Forestry Task Report, "Wildland Soils, Vegetation and Activities Affecting Water Quality."

Sediment yields from road construction are high; and completed roads, if not properly maintained, continue to contribute large amounts of sediment. Construction near a streambed may contribute sediments directly to the stream. Additional loads result from storm water runoff passing over the freshly cut hillsides, and the unsurfaced backroad is a constant potential contributor of sediments.

Narrow, small roads often follow contours with a minimum of cut and fill. The narrow size will minimize the impact, but the inexpensive construction may result in washouts, slides, and forms of surface erosion. As the road standards are raised to provide straighter roads and greater width, potential erosion problems increase. Economics usually dictate a more stable road with fewer slumps and slides; large cuts are terraced; vegetation is reestablished; and adequate drainage is installed. Nevertheless, the initial effect may be to sharply increase sedimentation with a long-term moderate contribution.

There is a scarcity of quantitative data on the sediment yields of roads. It was recently noted that in a small, steep watershed of Oregon road construction increased sedimentation by an estimated thirty times over undisturbed conditions. Landslides associated with the severe storms of 1964-65 were 72 percent attributable to roads. Erosion increases exponentially as road density—miles of roads per square mile of area—increases.

Major attention given to subdivisions and water quality is usually concerning wastewater problems. The common form of wastewater treatment is septic tanks and these considerations are considered in a separate section. This discussion will deal with sedimentation aspects of subdivisions.

Increased sedimentation is directly related to two aspects; namely, roads and roofs, and indirectly related to fire. The heavy concentration of roads greatly accelerates the runoff and their construction will expose open areas for sheet and gully erosion. Similarly, the sealing of soil surfaces with walls, roofs, drives, and patios will reduce infiltration rates with an increase in runoff. Aided by storm drains and improved channels, runoff flows accumulate much faster. This will result in a three- to five-time increase in peak discharge. Downstream, the greater volumes and velocities in small streams will increase bank cutting, channel scouring, and sediment transporting capacity. Culverts and small bridges are subjected to larger than anticipated flows with an increased rate of failure.

Indirectly, subdivisions increase sedimentation through their influence on fires. Increasing numbers of people in the foothill and mountain areas cause increasing numbers of wildland fires. Additionally, fire fighting efforts are sometimes hindered. Homes must be saved while the remainder of the fire spreads rapidly out of control.

An analysis of tree ring growth indicates fires have occurred every two to eight years in the Sierra Nevada before the arrival of the white man. Dry, hot areas of southern California also experienced frequent fires.

Up to twenty years ago, man's fire suppressing activities diminished the acreage burned each year. Since this time, the percentage of large fires has continued to decrease slowly, but annual acreage burned seems to be increasing slightly in recent years.

The effects of fire on water quality will depend on the intensity which controls the degree of soil damage and potential nutrient losses. High intensity fires destroy all vegetation, including roots and seeds, and oven dry the soil. Due to the absence of moisture and capillary action, the top few inches of soil will refuse water, and sheet and gully erosion are greatly intensified. In the southern central coast it is estimated that it takes twenty-five years for a burnt over area to return to its native chapparral vegetation. Thus the degree of potential damage continues to increase after the climax vegetation matures until the ratio of fuel decay stabilizes.

Low intensity fires occur in low fuel areas or in high fuel areas with humid, mild weather. Often, sufficient litter remains to protect the soil. Grass fires are of such low intensity that the remaining stubble will protect the surface. Much of the root system and many of the seeds survive to regerminate during the rain critical period.

Sediment yield from all fires is great. Flood flows scour and erode as well as pick up and transport abnormally large amounts of sediments and debris. Large intense fires, followed by an above average rainfall, will result in maximum damage. In 1971, two comparable streams in southern Santa Barbara County experienced peak runoffs of 250 cfs and 6,000 cfs following the same storm. The difference was attributed to fire.

Mining

The State Department of Mines and Geology list 32 major active and inactive mines in the southern Central Coastal Basin. Additional mines are present, but they do not have potential for causing water problems or their production is less than $100,000. Surface mines number 16 and underground 16.

The major types of mines in the basin are for petroleum products, mercury and sand and gravel. Other ores and minerals such as diatomite, copper, limestone, and chromium, have been mined on a limited scale.

The principal water quality problem caused in hard rock and sand and gravel mining in California involves turbidity and siltation. For this reason, mine operators are not allowed to dispose of tailings where they may cause such problems. Dust created during summer mining and rock crushing activities collects on the surrounding surfaces, including vegetation. During the first rain, these particles are carried in sheet runoff to surface streams. Sand and gravel pits in river beds must take place away from the main stream channel. Settling ponds are also used to settle out suspended solids before recirculation or discharge.

Most oil and gas extraction produces a wastewater byproduct generally as a brine solution. The wastewater brines contain sodium and calcium salts as well as boron. Small amounts of potassium, magnesium, mercury and fluorine are often present.

Fluid migration is a constant potential problem in most wells unless precautions are taken. Salt waters encountered may travel vertically in the well column to degrade a fresh water stratum.

Injection is a specialized process for (1) rejuvenation of abandoned wells and (2) disposal of wastewater brines. The poor quality brine, injected under pressure may contaminate the fresh water aquifers or alter subsurface fluid migration with a resulting degradation.

Transportation of the final product plus the brines presents another source of potential degradation. Pipelines, ships, rails and trucks are used for transport, each having special considerations.

In sinking a well, special care is taken to ensure against blowouts and contamination of fresh water aquifers. A blowout is an uncontrolled flow of fluids from a well which may result in large amounts of oil, gas and water being discharged into surrounding water systems. Control of blowouts is accomplished primarily by the use of drilling fluid (mud) composed of fresh water and clay. This column of mud will prevent fluid migration between the aquifers encountered and the weight of the column will overbalance any pressure that may be tapped.

Once the fresh water-salt water interface is encountered, casing is placed and cemented into the hole to protect these waters from contamination. Termed the surface string, the casing is connected to the top of the surface line.

A practice often employed to aid in the recovery of oil is injection and flooding. Injection is also a method used for disposal of brines. Brines brought up from a producing well are injected in a non-producing well. Many water quality considerations are similar whether the injection is for recovery or disposal.

As the domestic supply of oil decreases and the demand increases, oil formerly uneconomical to recover will become more attractive. A substantial amount of this oil is the oil left in a reservoir previously abandoned due to a decreased yield. Secondary recovery such as injection can economically be used to surface this reservoir.

Secondary recovery methods include flooding, gas, air or steam injection plus thermal combustion. The amount of fluid injected, pressure required, source of injection water and zone of injection are important water quality related consideration. Saline waters, often used for injection, may contaminate a fresh water reservoir when injected under high pressures. The increased pressure could result in lateral travel of connate water to another well where vertical travel could cause surface or subsurface degradation. Assurance against such an occurrence would require that only wells of high integrity be used for injection whether it be for recovery or disposal.

Problems related to degradation due to injection have not been noted in the south Central Coastal Basin. The Division of Oil and Gas oversees the process; recommendations and requirements are handled on a case-by-case basis due to the variations in geology and groundwater hydrology, from site to site, and the integrity of each well. The Regional Board usually favors this method over sumps and ocean outfall.

Sumps, used for the storage of oilfield waste fluids, are restricted as to location and construction. Sumps should be constructed outside of natural drainage channels and be lined to prevent percolation. Additional construction requirements to prevent degradation are implemented by the Division of Oil and Gas and the Petroleum Engineer's Office of Santa Barbara County. Sump walls must be free of slump, erosion features or animal burrows, have no low spots or leakage, and if containing flammable fluids, be free of weeds and brush. One problem experienced with sumps is that migrating water fowl sometimes use them for stopovers. Sump waters containing oil can be detrimental to lethal for the birds, depending on concentrations. Sumps should be sized large enough to contain rain waters to prevent spillage during the wet winter periods.

Abandoned wells may result in subsurface degradation. Fluid migration between strata may slowly degrade a good quality aquifer and surface seeps may develop long after abandonment. To assure that the groundwater supplies are protected and preserved for future use, the State Department of Water Resources has developed water well standards that include abandonment procedures for all wells. The procedures ensure against the interchange of waters where such interchange will result in significant deterioration of all water leaving formations penetrated.

Monitoring to assess the degradation from abandoned wells has not been conducted on a large scale and data is not available to note cases of degradation due to improper abandonment. Moreover, the Division of Oil and Gas oversees the abandonment of each extraction well and procedures are issued on a case-by-case basis. Abandonment requirements do not necessarily parallel those developed by the State Department of Water Resources. It should be noted that a Santa Barbara County ordinance provides an additional measure of supervision through the County Petroleum Engineer. The office was created in 1937 following oil discoveries in the Santa Maria Valley. The oil well ordinance adopted by the county requires the oil well drillers to take several precautions in drilling and abandonment. Generally, the Santa Barbara ordinance is more restrictive than requirements of the Division of Oil and Gas and the abandonment procedures in the Department of Water Resources Water Well Standards.

Initial blowouts or uncontrolled spills at inland sites present minor problems to fresh-water environments as most of the oil falls on soil where it causes little damage and disappears rapidly as a result of biodegradation. At sea, however, blowouts or other uncontrolled discharges deposit petroleum on marine waters where rapid surface spreading, waves, winds and coastal currents make containment and removal almost impossible.

The degree of damage from oil spills will partially depend upon the character of the surrounding waters and resident aquatic life. Aquatic life, recreational use and aesthetic enjoyment are usually most sensitive to oil pollution; examples of immediate effects include death or debilitation of waterfowl, fouling of boats and shores and poisoning or smothering of coastal marine life.

The propagation of marine plants and animals can be affected by oil spills but recovery is usually rapid. The adverse elements include volatile, soluble and floating oil. Water-soluble fractions in the oil present the greatest threat. With discharges reasonable far off shore, such as the Torrey Canyon and Santa Barbara oil pollution incidents, the more volatile and soluble fractions that may cause toxicity are quickly weathered, leached out and dissipated in the marine environment or on the shore.

Floating oil that reaches the shore and shallow water can be temporarily damaging. Aesthetics suffer greatly and the oil adheres to rocks, sand, plants and birds. Such contact with waterfowl can be lethal.

Oil spills also result from oil tanker breakups, blowouts and tank or pipe failures. Several miles of pipelines stretch across California carrying millions of gallons of crude oil or refined products annually. Some sections cross water courses and run near the estuaries and sea. Fortunately, major spills from pipelines are almost nonexistent. Pipelines are well monitored so that leaks can be quickly detected. Also, automatic shutdown of pumps or quick closing valves minimize discharges during breaks in the line.

Huge oil tankers and offshore oil wells continue to present the greatest threat of oil spills to the miles of coastline along the southern Central Coastal Basin. Oysters and clams in tidal flats where floating oil washes ashore are vulnerable to heavy mortality from oil-coated cilia and gills. Cleanup actions that weight the oil to make it sink, such as clay or chalk additions, subject benthic animals to high concentrations of toxic principals. The removal of the benthic organism reduces the cohesion of sediments. Contaminated segments, spread over great distances under the influence of tide and wave action, transport the oil to areas not immediately affected. The oil remains are invisible, but environmental damage to the initially uncontaminated area can be as great as the originally contaminated site.

The potential for spills is related to many variables, one of which is tanker size and volume shipped. Presently, 4½ trillion barrels of oil are transported annually. By 1980 this number is expected to increase to 6½ trillion barrels. Most tankers are in the 100,000 dwt (dead weight ton) size, but supertankers of 200-312,000 dwt ply the seas. Super supertankers of 475,000 dwt are now under construction and 750,000 to 1 million dwt vessels are being planned.

The dangers of collision may be less due to fewer ships needed, but the potential size of a catastrophe is astonishing. Moveover, their large size renders them less manageable. The **Universe Ireland** (312,000 dwt), for example, requires 15 miles to come to a full stop with all screws stopped and travels three miles even after both screws have been put at full astern.

Draft requirements for the large tankers are requiring some revolutionary ideas for port facilities. Presently, ports in San Francisco Bay can only accommodate ships of up to 100,000 dwt. A limiting factor is the Golden Gate Channel with a depth of 53 feet. Dredging the channel to 65 feet would increase the channel capacity to accommodate ships of 250,000 dwt.

An alternative to conventional port facilities is the supertanker offshore port. The U.S. Army Corps of Engineers has proposed an offshore site outside the Golden Gate for one of six sites on the West Coast which should get top consideration for development as supertanker ports. As envisioned, the port would handle ships up to 475,000 dwt. One alternative incorporated in the proposal involves two sets of pipelines, one to the refineries in the East Bay and another to the refineries in the Los Angeles area. The second set of pipes to the Los Angeles area would be built in lieu of a supertanker offshore port near Los Angeles.

Standard Oil Company of California is studying the construction of an oil tanker superport 3 miles offshore from Estero Bay near the site of present terminal facilities, northwest of San Luis Obispo. The preliminary plans indicate the floating facility will serve both the East Bay and Los Angeles refineries from the single location capable of handling tankers up to 200,000 dwt or more. Submerged pipelines will connect the floating superport to Standard Oil's crude lines in the San Joaquin Valley. Presently, San Joaquin Valley lines extend to both the East Bay and Los Angeles refineries. Additional lines could be constructed on the same right of way, and nine new storage tanks, each holding one-half million barrels of oil, would be constructed onshore.

The environmental report prepared by the Corps for its recent deepwater port study, concluded the environmental impact of a supertanker port at Estero Bay would be extremely adverse on biological resources, aesthetics, recreation and open space in the coastal area.

The question of supertanker ports, their location, size and environmental impact is obviously not one confined to the southern Central Coastal Basin alone. Rather, it is related to the needs of the West Coast for crude oil and a port to handle the economically desirable supertankers. Should the Estero Bay facility prove to be the most economically feasible location, it is imperative that the facility be constructed and operated to minimize degradation. The planning is still in a preliminary stage, and justified alterations are still possible.

Presently, the two refinery nodes, San Francisco Bay and Los Angeles, are importing 454,000 barrels of oil per day from Alaska and foreign sources, by 1980 this figure will grow to 1,928,000. This reflects the continuing dependence on oil as a source of energy and declining domestic production. All of this oil will not be transported in supertankers, but the figures are portentous of the future tanker traffic that may call at Estero Bay.

Secondary additions may possibly follow the initial construction. The Phillips Petroleum Ekofisk oil field in the North Sea has recently sunk a 215,000-ton concrete storage tank in 230-ft. deep water. The 1-million barrel capacity tank will store crude oil production if weather conditions prevent offshore tanker loading. Such facilities, in addition to the aforementioned deep port facilities, have the potential of producing small but continuous leaks. Researchers are in almost total agreement that this type of spill may in the long run be more ecologically degrading than the large headline capturing large spills. The well-planned and carefully developed deepwater port, however, will minimize environmental impacts.

Logging

Sensitivity of all streams in the basin to logging and logging road building activities could be identified following rigorous analysis of geological, pedological, hydrological and biological data plus field inspections. Relative sensitivity could then be portrayed on a large map. The sensitivity would also consider beneficial uses which are not directly associated with ecological systems. Upon receiving a timber harvest plan, the regional board staff could locate the operation on the sensitivity map and determine the approximate amount of risk involved. This information would enable the board to evaluate the method of operation and the adequacy of proposed mitigation actions or special considerations. The success of this step would somewhat depend upon the degree of cooperation provided by the Division of Forestry. Timber harvest plans should be required to contain sufficient detail for evaluation, and the regional board should be allowed an ample amount of time for review before commencement of logging operations.

The proper logging method to be used at each setting is a function of the terrain, species and other timber considerations. Often the afore-mentioned are compatible with water quality management, but in cases where water quality may be degraded, mitigating measures to preserve the character and quality of the water course should be taken. Since the Division of Forestry is familiar with the limitations and relative degradation potential of the various harvest methods, it should take the lead role in incorporating necessary mitigation measures into the permits and seeing that they are enforced.

Two possibilities exist to deal with negligent operators. The Division of Forestry can revoke the operator's license or the Regional Board can implement enforcement action. While both methods are necessary and effective, they are after-the-fact methods except for deterring roles. Thus, the major emphasis should be placed on control measures rather than enforcement actions.

Chapter 17 Assessment of Alternate Control Measures

Environmental factors described in Chapter 6 were used first in developing the alternative plans described in Chapter 16 and later in rating different alternatives in terms of environmental impact. The environmental sensitivity approach described in Chapter 6 included consideration of governing water quality factors relative to waste discharge to ocean waters, streams or land as well as the terrestrial impact of conveyance or treatment facilities. Social factors were also considered in the environmental ratings.

GENERAL CONSIDERATIONS

A brief discussion of ocean and land disposal impacts can be found in Chapter 6. Stream disposal impacts are less frequently encountered and they are discussed under the appropriate sub-basins in Chapter 6 and later in Chapter 15 for the Salinas River and San Luis Obispo Creek cases.

A further general discussion of ocean and land disposal environmental impacts is offered here as background. Additionally, the impacts associated with conveyance and treatment facilities are described in a general way.

Environmental Implications of Ocean Disposal

Several regulating factors pertain to ocean disposal in the Central Coastal Basin, they include:

1. State Ocean Plan, which includes the stringent requirement that diffusion systems be designed to achieve an immediate wastewater dilution ratio of 100:1 at least 50 percent of the time and 80:1 at least 90 percent of the time.

2. Secondary level treatment or a discharge of equivalent quality is required. Although oxygen demand removal is not stressed, removal of solids, turbidity floatables and toxicants is assumed equivalent to biological treatment.

3. Waste discharge requirements established by the Regional Board ascertain that the discharger meets appropriate waste treatment standards.

4. Ocean Plan receiving water standards establish limits for use of assimilative capacity that are assumed to protect beneficial uses.

5. Monitoring programs determine compliance with effluent and receiving water standards.

6. Projected future wastewater discharges under the plan are not large; all are less than about 30 mgd; most are less than 10 mgd.

Municipal treatment plant discharge in this basin is mainly of domestic and commercial origin; the few industrial contributions are mainly related to food processing. Upon discharge most wastewater constituents are almost immediately diluted to a dilution of 100:1 by diffuser design, jet action and buoyancy. Location of outfalls offshore in relatively open waters is thought to prevent long-term storage impacts or stagnant areas; thus, general flow and dispersal away from the initial point of discharge proceeds at a rapid and continuous pace. All of the foregoing should be kept in mind when conceptually assessing the potential effects of an individual waste discharge.

Treated wastewater retains properties that influence the ecosystem in the vicinity of the discharge and the surrounding area. These influences may be large enough to alter the biological community in species composition, productivity and usefulness to humans. The concept portraying the fate of wastewater materials has been displayed in many models. Figure 17-1 is a simplified schematic diagram of such a model. Substances not entering the biological cycle (conservative) are dispersed generally at the mercy of hydrodynamic and gravitational forces. Substances entering the biological system initially disperse with fluid flow, but depending on the substance, later become a part of the food web which then may regulate pollutant dispersion characteristics almost independent of physical forces. It is mainly in the biological cycle that wastewater pollutants accumulate and thus may become environmental problems.

Solids in waste effluent may be partitioned into settleable, floatable and suspended solids. Because of the nature of secondary treatment and the turbulence in the receiving water, solids are almost always suspended. If stormwater is treated and sludge is disposed of on land, one expects very little settleable or floatable matter of sewer origin to accumulate on the bottom or surface, respectively. The discharged material is mostly a flocculent type containing decomposing organic matter, bacteria and microinvertebrates. These suspended materials will disperse with diffuser jet action-buoyancy and natural current flows and subsequently be incorporated into the food chain by filter feeding organisms. Bacteria, viruses, and pathogens are kept from the shoreline and shellfish beds by the extended outfall, thus time and dilution prevent pathogenic organisms from occurring in concentrations sufficient to cause contamination. Insoluble mineral and some organic fractions will eventually settle to the bottom in deep, quiescent water. They may then be consumed by benthic feeding organisms. Materials settling to the bottom may cause alterations in the physical-chemical nature of the bottom habitat but not often to a degree harmful to benthic organisms.

Dissolved substances generally disperse in the vicinity of the outfall in accordance with the physical dynamics of the situation. Thereafter substances and ions not dispersed by current flow or various physical-chemical mechanisms reach an equilibrium consistent with the constant chemical character of sea water. Most dissolved carbonacious substances readily enter the food chain while a few are refractory and not easily subject to biological change. Nutrients and some trace elements are rapidly taken up by plants. Some ordinary trace elements such as heavy metals, may be taken in and accumulated by plants and animals, i.e., so called biomagnification. The same is true for some exotic organic chemicals, e.g., DDT, PCB and petroleum residues. One may judge that almost all chemicals in concentrations greater than historical ambient levels will appear in animal and/or plant tissue at greater than normal concentrations. Except in instances where damage has been documented, the significance of these elevations is only subject to speculation. Because of the great dilution at small secondary wastewater ocean outfalls, biomagnification to detrimental proportions is not expected. However, it should be remembered that every waste discharge contributes to the food chain increments of exotic chemicals that in the future may become an impairment to a beneficial use. It is uncertain whether any level of treatment fully avoids this possible problem.

Depending mainly on current velocity and direction settleable particulate materials are deposited on the bottom at some distance and location from the point of discharge. Because currents usually follow patterns, settleable solids may disperse widely but still settle and concentrate in distinct areas. Secondary treatment reduces settleable solids to relatively low values; settleable particles remaining have slow settling rates, thus distance of transport and dispersion away from the outfall is likely to be great and the potential for the concentration of beds on natural bottom sediments is correspondingly reduced.

Particulate matter that does reach the bottom may alter the mechanical composition of sediments and also add decomposable organic matter, refractive organics, and ionic minerals adsorbed to the particles. Since many organisms depend on particular substrates for their biological success, alteration of the mechanical composition of bottom sediments may displace or reduce the productivity of such organisms. On the other hand, the ecological position of some species may be enhanced especially by the importation of digestible organic matter. Chemicals imported into the biocoenosis will enter the food chain where some will accumulate according to the characteristics noted as biomagnification. Biomagnification and the effects of some chemicals have been documented, e.g., copper causes greening in oysters, DDT causes reproductive failures, mercury reduces usefulness of fish as food and bacteria may contaminate the digestive tracts of shellfish. However, significant detrimental conditions associated with small deepwater ocean discharges have not been documented.

Because of turbulence, current velocity, and small particle size, most particulate matter is retained in suspension for dispersion by physical forces and uptake into the food chain. Organic matter (detritus) is assimilated by bacteria while bacteria and detritus are consumed by filterfeeding invertebrates which in turn, are eaten by predaceous invertebrates and fish and so on. During this flow through the biological system, carbohydrates are oxidized to CO_2 or retained in tissues as fats and proteins. Other substances such as nitrogen, sulfur, and trace elements may be retained in tissues or may enter mineral cycles. All of these actions tend to return wastewater constituents to their natural role in the environmental system.

As previously noted, substances that bioaccumulate present the greatest potential hazard from all waste discharges. Chlorinated hydrocarbons, certain heavy metals, and refractive organic chemicals, especially petroleum residues, readily enter the food chain and tend to accumulate or concentrate in long-lived carnivores, fish, birds, and mammals. Except in limited instances, the biological meaning of these accumulations is unknown, but with the evidence at hand, one must look on the phenomenon with caution as to the long-term detriment to the aquatic community and man. Up to this time, study of this potential problem, except in the laboratory, has been primitive; thus, for the present at least, expert judgment must take the place of knowledgeable decision making.

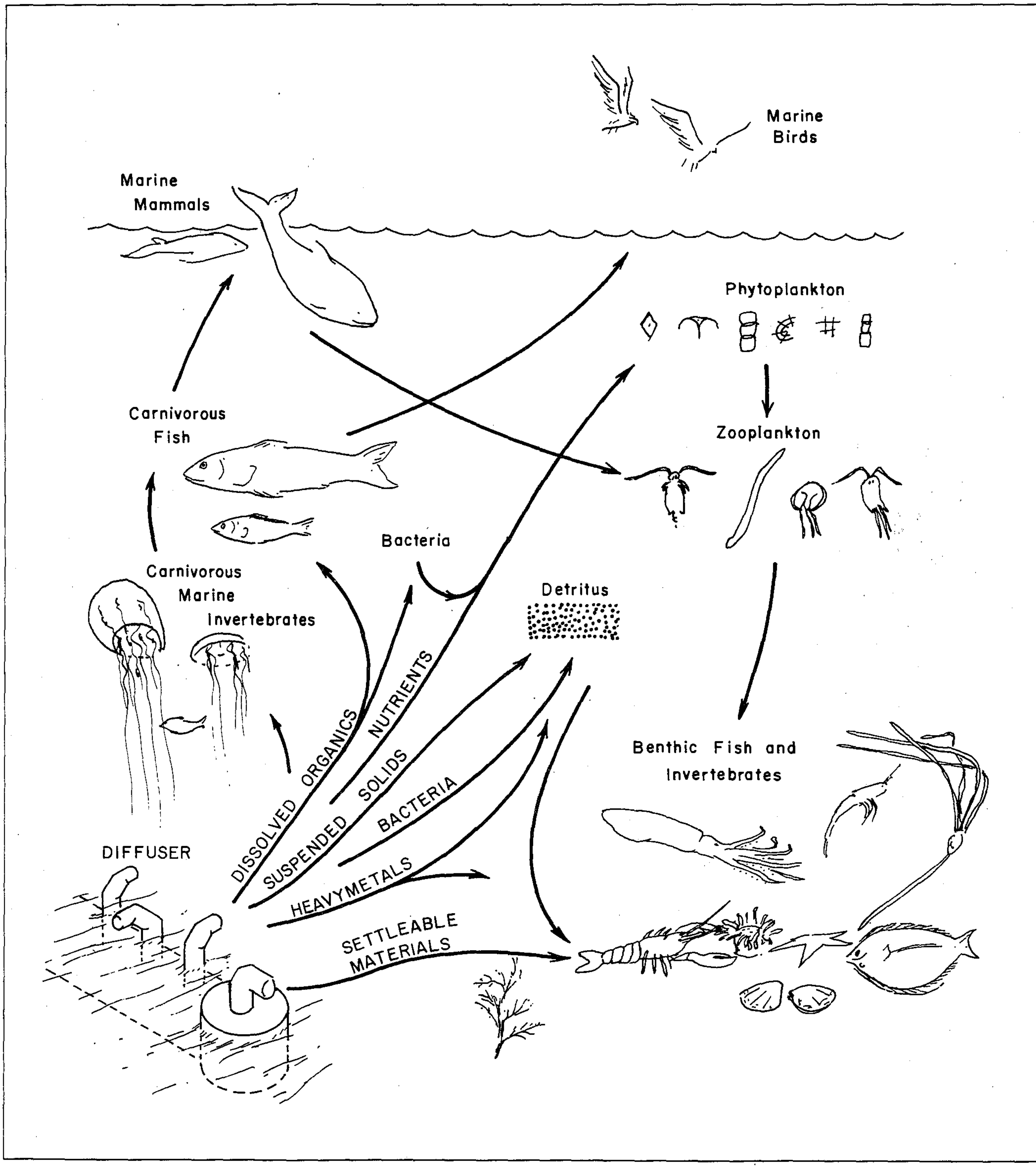


Fig. 17-1 Dispersion of Wastewater Materials into the Biological System

Oxygen demanding substances, i.e., BOD and ammonia, will utilize oxygen available in the dilution water. But since the dissolved oxygen at outfall locations is probably near saturation and immediate dilution is generally greater than 80:1, the average effluent biological oxygen demand and ammonia concentrations of 20 and 40 mg/l respectively, are not expected to cause an environment altering depression of ambient dissolved oxygen.

Biostimulants will be dispersed and consumed in plant growth. They also enter a biological system which has a great capacity for increased primary productivity without incurring the symptoms of excessive eutrophication. Small ocean discharges are not expected to cause excessive eutrophication, but may increase the production of harvestable fish and shellfish.

Environmental Implications of Land Disposal

Two general kinds of land disposal are most prevalent—irrigation of grassland and percolation or ponding. Irrigation may use a combination of evapotranspiration, plant cropping, soil filtration and percolation to the groundwater for final treatment before disposal. During the process of evapotranspiration, chemical substances are concentrated in plant growth and the soil. Some of these may be removed from the disposal site by grazing animals or harvest vegetation. This process seems capable of removing significant portions of nitrogen. Many organic waste materials are converted to humus and mineral soil by soil micro- and macro-organisms. The viability of this community and the degree of humification depends mostly on the disposal of low toxicity, neutral or basic wastes and maintenance of aerobic conditions. Anaerobic acid soils may cause plant growth and rapid humification to cease. Soil organisms consume and adsorb heavy metals and organics in the same fashion as aquatic forms. Birds and mammals feeding on soil biota in turn concentrate some pollutants such as mercury, lead, DDT, etc. Except for these and a few other substances, not much is known about environmental or public health consequences.

Some conservative chemicals are retained by adsorption and ion exchange mechanisms. This phenomenon is more prevalent in solids containing significant clay fractions. Water percolating through the soil carries dissolved salts and nonpolar organic substances with the groundwater. The buildup of salts in the groundwater in areas where TDS is already high is often a critical concern. The addition of boron or nitrates can become agricultural or public health hazards respectively.

Land disposal may take place through the use of evaporation ponds. If sealed, these ponds retain all nondecomposable waste materials within the pond. Many such substances become locked up in a sludge that forms at the bottom. Biological growth in such ponds may be limited to a few species of great productivity. Birds and mammals feeding on insect, fish and amphibian life in evaporation ponds may concentrate bioaccumulateable substances, some of which are toxic, in the same fashion as fish and soil invertebrates.

Impact of Conveyance and Treatment Facilities

The use of land for conveyance, waste treatment, or disposal purposes usually requires the conversion from some former land use. Impacts on the natural or human environment are almost always contingent on the characteristics of the conversion. Conveyance systems typically follow existing rights of way or cross open land. Disturbances are generally short term and not permanent. The placement of treatment facilities is a long-term conversion and whatever impacts occur are considered to exist for 50 or more years. If conversion requires the displacement of natural vegetation, it means the loss of wildlife habitat. Sometimes this loss can be mitigated by landscape design while in the other instances habitat is totally foregone. Of particular concern is the loss of marsh—wetland and pockets of productive wildlife habitat in urban areas. The situation of each plant siting needs to be assessed relative to its potential to damage natural habitat significant to the local community or to rare and endangered species. The same holds true for land disposal areas. However, land disposal may be managed to improve wildlife through the creation of more productive habitat. Each situation must be evaluated to ascertain the impacts and trade-offs associated with the project.

ENVIRONMENTAL EVALUATION

Alternative water quality control measures described in Chapter 16 can be assessed in terms of their merits or deficiencies relative to environmental impact. This aspect of the planning process is important since the plan is intended to improve environmental quality; although water quality is emphasized, pollution impacts are not to be shifted to another media. Total environmental effectiveness is stressed as emphasized in the EPA water strategy:

"Treatment methods must be judged in terms of their net environmental effect. Care should be taken that pollutants addressed are germane to the local water quality problem, and that abatement practices to restore surface water do not shift an environmental problem to other less remediable media."

Alternatives are discussed in a more general format than that presented in the National Environmental Policy Act. It is the intent of this chapter to include considerations which influenced plan selection and not to repeat impacts from alternative to alternative which, in the case of construction of wastewater treatment and disposal facilities or disposal to ocean or land, would involve considerable repetition. These more common impacts are discussed in Chapter 6 and to some extent in the previous discussion on general considerations.

Accordingly, differences in alternatives are emphasized in the text of this chapter although an environmental rating is included for some of the planning areas where questions are more complex or where impacts are more likely to affect a larger population. Discussions and ratings include the "no action" alternative.

The environmental ratings employ a qualitative scale which covers a range from disruptively negative impact (considered as deleterious to the environment) to beneficial impact or positive effects. Negative effects are assigned a degree of severity ranging from -10 to -1 on a logarithmic scale. Positive impacts could have been quantified in a similar way; however, it was decided to employ a simple indication of benefit rather than attempt to rate differing degrees of good effect. This approach could be debated; however, it is more conservative. Situations considered not applicable or having no impact are assigned a zero (0) and problematical impacts or unknown effects are assigned a question mark (?). A color code was used for easy reference wherein red is negative, blue is positive and black is negligible or problematical.

Ratings were made by the project planners with major imput from the Environmental Consulting firm of Jones and Stokes, Sacramento. There is a subjective judgment in all ratings and as a consequence these ratings may be subject to challenge. The intent of these ratings and the brief discussion which is provided for each is to demonstrate the process used in evaluation of environmental factors. Plan selection relied heavily on these ratings as well as functional and economic evaluations described in Chapter 16. The ratings considered the listing of environmental factors listed below:

Physical/Chemical

1) Surface Water Quality

2) Surface Water Quantity

3) Groundwater Quality

4) Groundwater Quantity

5) Ocean Water Quality

6) Land Forms; Erosion Siltation

7) Land Quality, Soil Productivity

8) Atmosphere; Air Quality

Biological

9) Sensitive Habitats

10) Wildlife Resources, Rare or Endangered Species

11) Freshwater and Anadromous Fishery

12) Marine Fin Fishery

13) Marine Invertebrate Fishery

Social

14) Recreation

15) Registered Archeological and Historical Sites

16) Land Use, Open Space, Development

17) Public Health and Welfare

18) Social Acceptability

19) Population Density, Congestion

Aesthetic

20) Noise, Odor

21) Natural Scenic Quality

The environmental resource and constraint inventories shown on maps in Chapter 6 were used in this evaluation and in the formulation of alternative plans. The environmental evaluation of municipal wastewater facility alternatives is included here by sub-basin and by topic for other pollution sources.

Santa Cruz Coastal Sub-Basin

The Santa Cruz Coastal Sub-basin can be discussed separately since the study of alternatives showed no advantage for consolidation of wastewater management operations of that region with operations of another region.

If no action were to be taken, wastewater of the community of Davenport would continue to be treated and discharged to the ocean near the shoreline and the discharge would not conform to the State Ocean Plan requirements. There are no apparent significant adverse environmental impacts of such discharge to those waters, which are isolated from the public. No action carries little concern relative to Ben Lomond Conservation Facility where present practices are acceptable; no action at Big Basin State Park would deprive Waddell Creek of water quality improvements provided by alternative plans.

Reclamation or land disposal are the only viable options for all three dischargers — Davenport, the Ben Lomond Conservation Facility, and Big Basin State Park. Environmental impacts will be limited to wildlife habitat and physical characteristics. The plan should have little or no adverse impact on wildlife habitat. With proper design of the disposal facilities, treated discharges should be compatible with physical characteristics of the area. When Davenport provides land disposal, any conflict with the State's Ocean Plan will be eliminated. Ocean disposal consistent with the State Ocean Plan is not considered economically feasible for Davenport and would cause disruptive social impacts in view of financial hardship in this area; environmental issues related to municipal wastewater disposal are not major in this sparsely settled area; the most significant is the tradeoff between land disposal versus reclamation for stream release since public health questions may arise from stream discharge even after level IV treatment; however, it is recognized that summer stream flow would drop in the small streams affected, such as Waddell Creek if land containment were pursued. This has been discussed in Chapter 6.

San Lorenzo River and Aptos-Soquel Creek Sub-Basins

Alternatives for the inland region and coastal region of the San Lorenzo River and Aptos-Soquel Creek Sub-basins are discussed below.

If no action is undertaken in the inland region there will be a continuation of the present risk that seepage from septic tank leach fields in the Scotts Valley area and other areas will impart disease organisms to persons who contact or ingest receiving water of the San Lorenzo River, which is the source of drinking water for the community of Santa Cruz. Another risk continued would be that of fish kills caused by depression of dissolved oxygen in San Lorenzo River associated with such seepage. Thus the value of the river for fisheries, recreation, and municipal water supply will remain depressed or in jeopardy, a situation which will be aggravated as population increases the amount of wastewater that is discharged to septic tank leach fields and to existing small treatment plants which are now loaded near capacity.

If no action is taken in the coastal regions there will be a continuation of the present significant risk to health of swimmers at Soquel Cove, where wastewaters of the Aptos and East Cliff County Sanitation Districts are discharged, and a potential for degradation of aesthetic qualities of the waters of Soquel Cove by provision of nutrients which could stimulate blooms of algae. This area of Monterey Bay is highly sensitive to pollutant discharge (see Chapter 6). Both impacts, which would be aggravated by increases in wastewater flow associated with population growth, are significant adverse impacts on heavily used recreation and aesthetic resources of the water and beach area.

Alternatives for the inland and coastal regions are discussed below:

The environmental evaluation of alternatives for the San Lorenzo Valley compared to "no action" is summarized; to assist the reader in understanding the results, short descriptions of the impacts follow.

Primary impacts on water of the alternatives will concern surface water quality and quantity and the fishery and recreational uses made of those waters. According to the State Department of Health, runoff from septic tank leaching fields may be degrading the quality of the San Lorenzo River and adversely affecting the fishery, water

Table 17-1 Environmental Evaluation Santa Cruz-Soquel-Aptos Coastal Area

Scale for each alternative: -10, -3, -1, 0, +

ENVIRONMENTAL FACTORS	NO ACTION	ALT I	ALT II	ALT III
PHYSICAL / CHEMICAL				
WATER				
1) SURFACE WATER QUALITY	-3	+	+	0
2) SURFACE WATER QUANTITY	0	+	0	0
3) GROUNDWATER QUALITY	0	0	0	0
4) GROUNDWATER QUANTITY	0	0	0	0
5) OCEAN WATER QUALITY	-3	+	+	0
LAND				
6) LAND FORMS; EROSION SILTATION	0	0	0	0
7) LAND QUALITY, SOIL PRODUCTIVITY	0	0	0	0
AIR				
8) ATMOSPHERE; AIR QUALITY	-1	-1	-1	-1
BIOLOGICAL				
9) SENSITIVE HABITATS	0	-1	-1	-1
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	0	0	0	0
11) FRESHWATER AND ANADROMOUS FISHERY	0	+	+	+
12) MARINE FIN FISHERY	-1	0	0	0
13) MARINE INVERTEBRATE FISHERY	-1	0	+	0
SOCIAL				
14) RECREATION	-3	0	0	0
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	0	0	0	0
16) LAND USE, OPEN SPACE, DEVELOPMENT	-1	-1	-1	-1
17) PUBLIC HEALTH AND WELFARE	-1	+	+	?
18) SOCIAL ACCEPTABILITY	?	?	?	?
19) POPULATION DENSITY, CONGESTION	0	-1	-1	-1
AESTHETIC				
20) NOISE, ODOR	?	?	?	?
21) NATURAL SCENIC QUALITY	-1	-1	-1	-1
OVERALL RATING	D	B	B	C

KEY TO IMPACTS
- ● BENEFICIAL (+)
- ● ADVERSE (−)
- ● NONE / NOT APPLICABLE
- ? PROBLEMATICAL

OVERALL RATINGS
- A SUPERIOR
- B ACCEPTABLE
- C MARGINAL
- D UNACCEPTABLE

supply, and recreational uses. Land disposal alternatives should have less of an impact on the quantity and quality of surface and groundwaters in the Valley compared to existing conditions because flows would be collected and disposed of in a more controlled manner or where septic tanks are viable, a management district would maintain a higher level of operation. Alternatives providing for tertiary treatment and surface water disposal would be beneficial to recreation and fisheries in that summer flows would be augmented directly with a better quality water than would be produced by the other alternatives.

None of the plans for the San Lorenzo Valley area should have significant adverse effects on land forms; however it will be important in the siting and construction of treatment plants and pipelines to minimize erosion. Plans for consolidation call for construction of a major interceptor along the San Lorenzo River and siltation of the river bed would, of course, be damaging. Treatment facilities can create odor and noise problems but these problems are not expected to be serious in terms of air quality impact.

Significant ecological impacts will involve fisheries in the San Lorenzo River system which support trout and salmon. Land disposal alternatives should have little or no impact except as related to stream flow reduction in summer and the surface water disposal (tertiary treated wastewater) alternatives should have a beneficial effect on the cold water fishery.

Wastewater reclamation alternatives should enhance summer recreational uses of the San Lorenzo River by providing higher flows of a better quality. Low level dams are constructed to create summer recreation pools and the quality of water in these pools is generally poor before the end of the summer season. Low flows are insufficient to provide good circulation and nutrient loads introduced upstream create conditions of eutrophication.

The scenic quality of the San Lorenzo Valley would be impaired during construction of facilities but this impairment would not be lasting. Treatment plants and disposal facilities could be located in areas outside the river view. Land disposal schemes could be utilized to irrigate crops, pastures or parks.

In comparing Alternatives I, II and III there are more differences between Alternative I, which in essence retains present treatment configuration, and the other alternatives which involve more consolidation. As there is no real evidence that septic tank systems are causing problems it is probably more environmentally effective to conduct sewerage feasibility studies in the upper watershed to determine where individual systems are workable or unworkable and to schedule sewering projects based on such data as these feasibility studies would produce. Ratings between alternatives were considered comparable for all factors except item 5, land forms, erosion and siltation which would be negligible with Alternative I and problematical or adverse where extensive interceptor pipelines were required in this erosion prone watershed. Item 16 was rated problematical for Alternative I and negligible for the remaining alternatives since there is a possible risk from continued use of septic tanks; item 6 (land quality and soil productivity) and for ecological factors such as item 8 and item 10.

The environmental evaluation of alternatives for the city of Santa Cruz-Soquel-Aptos coastal area compared to "no action" is summarized in Table 17-1. The major environmental impacts of the alternatives will occur at the discharge locations or reuse locations.

Interregional alternatives for this coastal area (see Chapter 16) would each eliminate existing treatment facilities at Aptos and East Cliff which are discharging effluent into very shallow water close to shore. Alternative I would combine the flows in the region and provide for a long outfall off Pt. Santa Cruz protecting the fishery and recreational resources of the Bay. Nutrient concentrations in the North Bay would increase by less than 6 percent near shore and algal concentrations would increase by only 2 percent when comparing the year 2000 waste loads to existing loads. These small increases produced no detectable changes in the trophic levels investigated during the AMBAG study with the ecologic model of the Bay.

Alternative II is similar but includes importation of Watsonville wastewater to Santa Cruz for treatment and disposal and/or reclamation. Alternative III exports all wastewater from the coastal area around Santa Cruz eastward to Watsonville for treatment and disposal and/or reclamation.

Overall Alternatives I and II were rated as acceptable and Alternative III was considered marginal. Factors which contributed most to these findings were related to surface water quality (item 1) in the north pocket area of Monterey Bay; the sensitivity of this area to wastewater discharge, including nutrient imports, is discussed in Chapter 6. Marine invertebrate fisheries (item 12) are benefited most by Alternative II which eliminates waste discharge near Watsonville where contamination of shellfish has been a problem. Alternative I which retains both treatment facilities provides two centers for future water reuse rather than encouraging export of wastewater from one area to another; accordingly surface water quantity (item 2) can more readily be benefited in the two areas. Public health (item 16) and probably aesthetic factors are more clearly protected by Alternatives I and II than Alternative III, again because the sensitive north pocket area will receive less direct waste discharge.

Impacts on coastal land forms are not expected to be significant. Expansion of the Santa Cruz treatment plant will have to be carried out so as not to adversely affect Neary's Lagoon near the existing plant. Erosion must be minimized to prevent siltation of the lagoon which supports a variety of birds, small mammals, amphibians and insects.

Some noise and odor problems are to be expected in connection with an expanded Santa Cruz treatment plant which will be within a residential area. However, the plant site is fairly well isolated in the lagoon area and it is anticipated that noise and odor problems will not be significant.

The "no action" course of action would leave the Santa Cruz region with an intolerable and also illegal waste discharge problem. Beach closures due to excessive coliform counts and eutrophication of the north pocket area could well be experienced in the near future. Alternatives I and II involving a long outfall and upgraded treatment should protect the fisheries and recreational values of North Monterey Bay. However, an outfall must be carefully aligned so as not to disrupt rockfish in important reef areas off Pt. Santa Cruz. It was pointed out in Chapter 14 that under the most adverse conditions of onshore wind, bacteriological standards set forth in the State's Ocean Plan could be met with a long outfall off Pt. Santa Cruz.

Alternatives I and II would protect recreational values in the Bay. The major social impact would concern the use of Neary's Lagoon for a treatment plant site. However, it is entirely possible that the treatment plant could provide a supplemental source of water (secondary effluent) to the lagoon resulting in at least enough of a benefit to offset additional area required by the plant expansion. It is also possible that secondary treatment could be eliminated and that a less land intensive physical-chemical treatment plant could be developed at this site. See Chapter 5 for further discussion of this possible option for ocean discharge.

Alternatives for the coastal areas should have equal impacts on the aesthetic qualities of the region after construction, except for factors pertinent to water quality in the north pocket cited for Alternative III. The treatment plant could be blocked from view with appropriate landscaping and major facilities could be housed in structures which would blend with the surrounding environment. Even though the Santa Cruz plant is located in the lagoon area, serious ecological or aesthetic impacts can be avoided.

Pajaro River Sub-Basin

The City of Watsonville has been discussed to a limited extent in the previous section since interregional alternatives were developed which considered Watsonville with Santa Cruz and adjacent coastal communities along the north shore of Monterey Bay. Regional alternatives were also considered which emphasized either land or Monterey Bay disposal for communities in the vicinity of Watsonville. Reclamation and wastewater disposal considerations have both favored retaining the wastewaters from this area in the lower Pajaro River area. There is more potential for reclamation in this agricultural area than in the urbanized Santa Cruz area although use of treated wastewater on local artichoke crops has not been common practice and acceptance by the public, farmers and public health officials will be needed. Disposal to central Monterey Bay beyond the limits of the sensitive zones shown in Fig. 6-3 of Chapter 6 has been judged acceptable environmentally within limits; however, this is not believed to be sound for a much larger discharge such as would result from consolidation of Santa Cruz, Soquel-Aptos dischargers and the Watsonville area for disposal to Monterey Bay so near the sensitive zone. The primary reason for this judgment is that currents prevail in a northerly direction; accordingly it is more probable that wastes discharged here would be caught up in the counterclockwise gyre which is believed to prevail in the north pocket. This would not be a concern for discharges located further south. See discussion of current patterns in Monterey Bay in Chapter 6, Chapter 11 and in the AMBAG oceanographic study report. It should be pointed out that no action for this area carries less impact than in many areas, since the Watsonville discharge would have to be upgraded by the implementation of the State Ocean Plan; consolidation with small outlying areas would not occur as smoothly as is expected under a basin plan approach.

Smaller treatment facilities could be located in the watershed serving Aromas, Corralitos and Los Lomas-Hall; however, although local reclamation and reuse could be accomplished, the problem of winter disposal could present a problem. Good land disposal sites have not been identified in the Watsonville vicinity whereas acceptable sites shown as possible land disposal areas on Fig. 6-4 were described as part of the AMBAG study.

In the Gilroy and Hollister region, alternatives considered in the AMBAG study covered a broad range of alternatives ranging from individual treatment to provision of common treatment and disposal facilities. No action for this area in the sense that no basic plans were available would be expected to delay implementation of stricter salt source control measures and there would be no coordinated approach to areawide management options which are believed needed to determine if San Juan Bautista should be consolidated with Hollister.

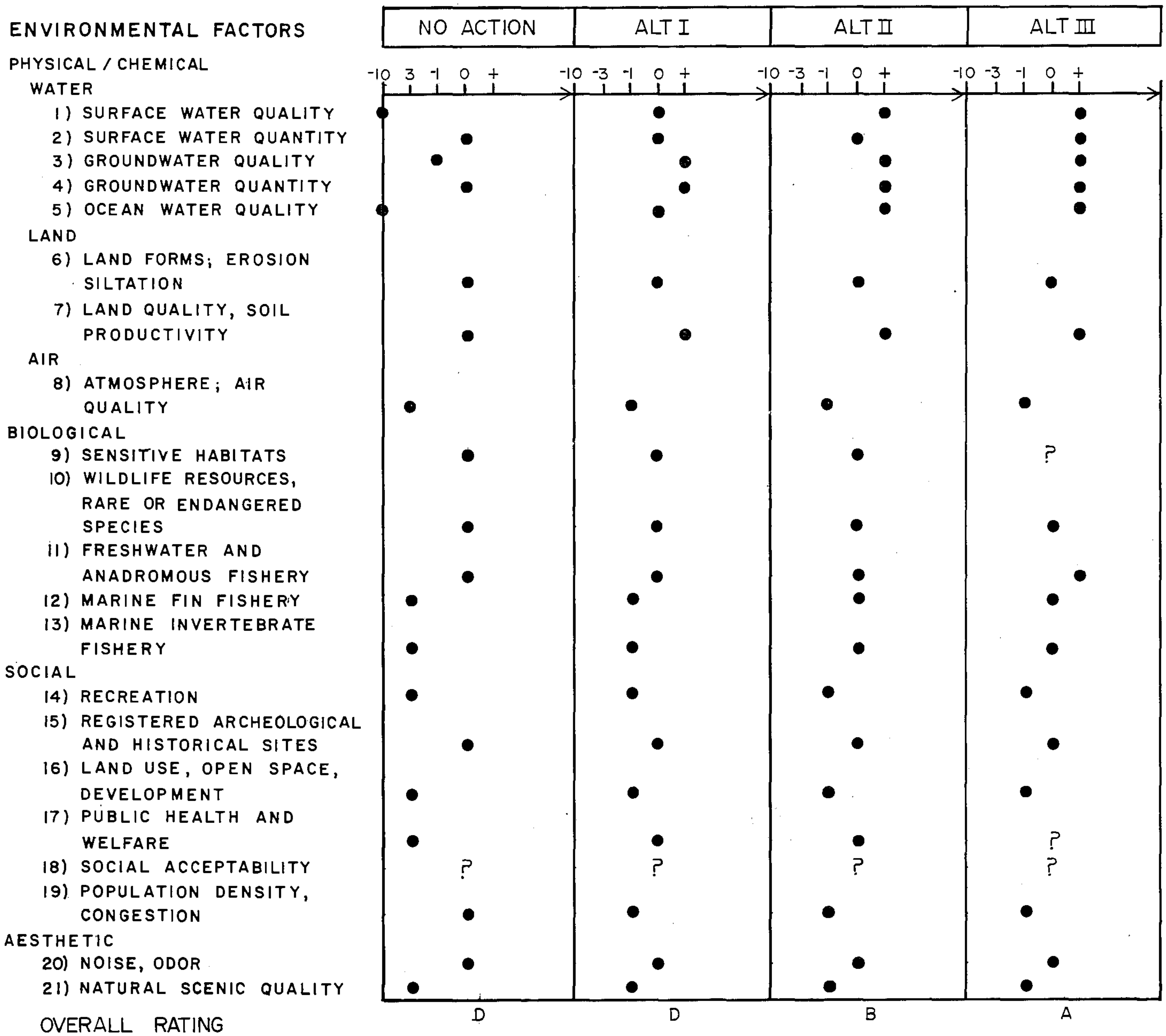
Environmental impact considerations for the Gilroy and Hollister regions are generally covered under discussions of land disposal in Chapter 5, Chapter 6 and earlier in this chapter. There are factors pertinent to both land disposal and source control of salts included in Chapter 16 and more specific discussion of impacts of land disposal by both irrigation and percolation for the Gilroy-Hollister area in Chapter 6. As treatment and consolidation options are available depending on the results of salt source controls it is difficult to compare alternatives beyond what has previously been discussed concerning land disposal in these areas. Options are more obvious for San Juan Bautista where present practices could be upgraded to eliminate surface water discharge by a separate land disposal operation or by consolidation with Hollister; the need for consolidation is dependent on the extent of treatment needed for percolation disposal which is dependent on the effectiveness of salt source control. Accordingly the emphasis in this region of the Pajaro River Sub-basin is first to improve effluent mineral quality and second to design in the most economic consolidation arrangement based on what is accomplished. In this sense the environmental concerns dictate treatment process and disposal site selection, whereas the level of consolidation follows guidelines based on economic analyses and reliability needed for the conceptual plan selected. Where greater consolidation occurs there will be a greater impact due to construction of pipelines which has been discussed under impact of conveyance and treatment facilities.

Salinas River Sub-Basin

Alternatives for the Salinas River Sub-basin are identified in Chapter 16 for the Castroville, Salinas, Toro and Monterey regions and upstream regions in the Salinas Valley, Nacimiento Reservoir and San Luis Obispo County. For purposes of discussion the more intensely developed downstream regions will be described separately from the more rural upstream regions. No action is an untenable program for the coastal area of Monterey Bay since there are short outfalls discharging to the environmentally sensitive south pocket area; see Chapters 6 and 14. It can be stated that outfall improvements would follow on implementation of the Ocean Plan; however the planning effort has evaluated aggregate effects and the sensitivity of discharge to the south pocket in a way which assures a better water quality control program.

In the area near Monterey Bay it was determined that interregional solutions were viable and the AMBAG study and subsequent reviews during the basin planning effort focused on interregional alternatives involving the Monterey-Castroville-Salinas area. Disposal of wastewater effluents was a major concern for these alternatives and levels of consolidation differed. See Chapter 16 and AMBAG study report. Effluent disposal, a prime consideration in the basin plan, was directed first to water quality control aspects and secondly to reclamation. It was determined that some interregional alternatives maximized water quality control while these same alternatives tended to discourage large scale wastewater reuse; other alternatives were identified which relied on or emphasized reclamation for agricultural reuse while having less reliable disposal in wet weather or more costly treatment as an answer for disposal to the Salinas River. There are subjective judgments implied in the above simplifications of the general problem of wastewater disposal and/or reclamation program planning for this area; however it can be stated that priorities were firmly set which established water quality control as the primary objective for the basin planning effort. Accordingly, plans were considered in

Table 17-2 Environmental Evaluation Monterey, Castroville and Salinas



KEY TO IMPACTS
- ● BENEFICIAL (+)
- ● ADVERSE (−)
- ● NONE / NOT APPLICABLE
- ? PROBLEMATICAL

OVERALL RATINGS
- A SUPERIOR
- B ACCEPTABLE
- C MARGINAL
- D UNACCEPTABLE

terms of their reclamation potential or compatibility with possible future reuse programs, but the most serious attention was given to the water quality control features of the plan.

Three alternatives are rated in Table 17-2 for the consolidated region covering Monterey, Castroville and Salinas. At the feasibility level for facilities needed prior to 1980, these involve discharge off Point Pinos (Alternative I), discharge to central Monterey Bay (Alternative II) and discharge to the lower Salinas River (Alternative III). The Salinas River discharge alternative is more directly tied to a wastewater reuse program than is either Alternatives I or II; benefits are shown in Table 17-2 reflecting water quality and quantity enhancement features of Alternative III. These same benefits do not accrue from Alternatives I and II to the same degree since reclamation is not so directly tied to plan implementation; however Alternative II does require placement of a major treatment center in the vicinity of lands suitable for effluent disposal or reuse. See Fig. 6-4 in Chapter 6. Alternative I does not provide as much incentive to reclamation although local reuse is not discouraged by this alternative.

Discharge off Point Pinos was a viable option during the AMBAG study and during most of the basin planning period; this disposal site was removed from further consideration by Regional Board action and is prohibited by specific reference in Chapter 5. The remaining interregional alternatives achieve different ends in terms of effluent quality and reclamation. Alternative III is rated highest environmentally because of the high treatment provided; however it is not strictly a water quality control plan. Alternative III is a reclamation plan which provides for water quality enhancement. Alternative II rated as acceptable is a water quality control plan which is compatible with the ultimate objectives of Alternative III and in this sense can be considered a first stage of Alternative III. It is considered more acceptable to stage the reclamation program for reasons of cost and the need to demonstrate that water reclaimed would in fact be put to beneficial use by local farmers and that alternative water sources from upstream sources such as the Arroyo Seco are not more desirable. For example, as with the lower Pajaro River area, it is necessary to demonstrate that reclaimed wastewater can be used on local truck crops including artichokes and lettuce without risk to public health. The regulations for wastewater reuse for such crops are necessarily strict and could be met with present technology; however reliability factors and acceptance of local farmers, consumers and public health officials need to be assured.

In the upstream areas the alternatives considered in the AMBAG study involved various levels of consolidation between numerous scattered communities. This inland area has generally employed land disposal technology with emphasis on irrigation in the dry season and percolation during winter periods; some areas rely more heavily on percolation even during dry periods. The communities of this rural area are small, the largest, Paso Robles, has an average wastewater flow of slightly less than one million gallons per day; most discharges average less than half this rate. As discussed in Chapter 16, consolidation of wastewater flows in this area was found to be economically infeasible. On the environmental side it is generally true that where land is used for effluent disposal or reuse, the amount of land required is directly proportional to wastewater flow. Accordingly, although there are economic incentives to consolidation of adjacent communities for surface water discharge, there are fewer advantages when disposal is to land since large land areas suitable for this purpose are not usually available near the treatment plant.

This consideration influences the rating of alternatives in the upper Salinas Valley, Nacimiento and San Luis Obispo areas of the Salinas Sub-basin. Environmental impact of alternatives considered involve more effects of conveyance facilities, questions of land disposal site suitability for larger scale operations near population centers and greater secondary impacts due to financial burden associated with consolidation alternatives. In general the recommended plan for this area of the Central Coastal Basin is very similar to no action in the sense that past controls and policies of the Regional Water Quality Control Board appear sufficient for this area. No action, in the sense that no basin plan would exist, would affect the minor consolidations suggested in Chapter 5 such as the transmission of the King City Airport waters to King City and the sewering of Templeton to Paso Robles; however even these programs were being encouraged prior to the basin plan development. Environmentally there is good reason to retain existing land disposal facilities in this portion of the sub-basin so long as increased emphasis is given to groundwater monitoring and salt source controls to assure continued protection of local groundwater quality.

Carmel River Sub-Basin

Alternatives for the Carmel River area as described

Table 17-3 Environmental Evaluation Morro Bay, Chorro Creek Area

ENVIRONMENTAL FACTORS	NO ACTION			ALT I - OCEAN			ALT II - PERC			ALT II - STREAM			ALT III - OPT 1			ALT III - OPT 2		
	MB-C[1]	CMC	LO-B[1]	MB-C	CMC	LO-B	MB-C	CMC	LO-B	MB-C	CMC	LO-B	MB-C+	CMC*	LO-B+	MB-C[a]	CMC[□]	LO-B[o]
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL																		
WATER																		
1) SURFACE WATER QUALITY	●	●4	?	a●			a●			●4			●	●4	?	?	a●	●
2) SURFACE WATER QUANTITY	●	d●	●	●7			●7			●7			●	d●	●	?	●7	●
3) GROUNDWATER QUALITY	●	●3	●3	●			●			●			●	●	●	●	●	●
4) GROUNDWATER QUANTITY	●	c●	●	●6			c●			●			●	c●	●	c●	c●	●
5) OCEAN WATER QUALITY	●2	●5	●5	●2			a●			●5			●2	●5	●2	a●	a●	●
LAND																		
6) LAND FORMS; EROSION SILTATION	●	?	●	?			?			?			●	?	●	?	●	●
7) LAND QUALITY, SOIL PRODUCTIVITY	●	?	?	?			?			?			?	?	?	?	?	?
AIR																		
8) ATMOSPHERE; AIR QUALITY	?	?	?	?			?			?			?	?	?	?	?	?
BIOLOGICAL																		
9) SENSITIVE HABITATS	●8	●8	●8	●8			a●			●8			●	●8	●	●	a●	a●
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	●9	●9	●	CONVEYED TO MB-C	CONVEYED TO MB-C	a●	CONVEYED TO MB-C	CONVEYED TO MB-C	●9	CONVEYED TO MB-C	CONVEYED TO MB-C	●	●9	?	●	a●	●
11) FRESHWATER AND ANADROMOUS FISHERY	●	●10	●	a●			a●			●10			●	●10	●	●	a●	●
12) MARINE FIN FISHERY	●8	●8	●8	●8			a●			●8			●8	●8	●8	a●	a●	●
13) MARINE INVERTEBRATE FISHERY	●8	●8	●8	●8			a●			●8			●8	●8	●8	a●	a●	a●
SOCIAL																		
14) RECREATION	●11	●11	●11	●11			e●			●11			●11	●11	●11	●	a●	a●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●	●	●			●			●			●	●	?	●	●	●
16) LAND USE, OPEN SPACE, DEVELOPMENT	●	●	●	●12			●12			●12			●12	●12	●12	●12	●12	●12
17) PUBLIC HEALTH AND WELFARE	●13	●13	●13	f●			f●			f●			f●	f●	f●	f●	f●	f●
18) SOCIAL ACCEPTABILITY	●14	●14	●14	g●			g●			g●			g●	g●	g●	g●	g●	g●
19) POPULATION DENSITY, CONGESTION	●	●	●	●12			●12			●12			●12	●12	●12	●12	●12	●12
AESTHETIC																		
20) NOISE, ODOR	?	?	?	?			?			?			?	?	?	?	?	?
21) NATURAL SCENIC QUALITY	?	?	?	?			?			?			?	?	?	?	?	?
OVERALL RATING	D	D	D	C			B			C			C	C	C	A	A	A

FOOTNOTES:

MB-C MORRO BAY - CAYUCOS SANITARY DISTRICT
CMC CALIFORNIA MENS COLONY
LO-B LOS OSOS - BAYWOOD

\+ OCEAN DISPOSAL
* STREAM DISPOSAL
a PERCOLATION WITH SPRAY IRRIGATION PLUS STORAGE
□ STREAM DISPOSAL NOW, PROVIDE PERCOLATION IN FUTURE
o LIMIT GROWTH NOW, PROVIDE PERCOLATION IN FUTURE
1-14 ADVERSE IMPACT EXPLANATIONS SEE NEXT PAGE
a-g BENEFICIAL IMPACT EXPLANATIONS SEE NEXT PAGE

KEY TO IMPACTS

● BENEFICIAL (+)
● ADVERSE (−)
● NONE / NOT APPLICABLE
? PROBLEMATICAL

OVERALL RATINGS

A SUPERIOR
B ACCEPTABLE
C MARGINAL
D UNACCEPTABLE

in Chapter 16 vary from separate land disposal at Carmel, Carmel Valley and Carmel Highlands to disposal to Carmel Bay and to ocean waters off Point Pinos. Earlier in the planning effort Point Pinos was a viable disposal site, see previous discussion regarding this site in the Salinas River Sub-basin. In contrast, disposal to Carmel Bay was to be covered by the Bays and Estuaries Policy which would have placed stricter limits on this mode of disposal than would the State Ocean Plan; more recently Carmel Bay has been identified as ocean waters by the State Water Resources Control Board.

The use of Carmel Bay as a disposal site can be questioned in view of the resources of this area. See Chapter 6 for discussion of Carmel Bay currents, water uses and aquatic life resources. There is a problem in assessing the environmental impact of alternatives in this area if only one disposal mode is pursued.

The possible combination of seasonal land disposal or reclamation with winter ocean disposal appears to be most acceptable from what is presently known of effects of the present discharge to Carmel Bay. It may be possible to direct all effluents to land in time; however, there are risks of transfering pollution impacts from the ocean to the land when wet weather effects are considered. Further documentation of conditions around the Carmel outfall is desirable to assess the adequacy of the outfall location and to determine if more emphasis should be placed on winter flow containment inland. From the information available it was determined that the more environmentally sound course was to consolidate Carmel Highlands and Carmel with ocean disposal as a near-term disposal mode, and seasonal land disposal with emphasis on reclamation for as much of the wastewater volume as is feasible. Meanwhile, the Carmel Valley area is maintained in a status quo condition pending the outcome of sewerage feasibility studies for this area; see Chapter 6 for discussion of impacts of this plan.

Monterey Coastal Sub-Basin

No further action is essentially the recommended plan for this area since present practices are acceptable at the small facilities in this sub-basin.

San Luis Obispo Coastal Sub-Basin

This sub-basin was divided into regions for purposes of discussion of alternatives in Chapter 16. A discussion of environmental ratings is provided here for two of the four regions described since alternatives for these areas (Morro Bay and San Luis Obispo Creek) range over a broader area. The north coast region, which includes Cambria and the San Simeon area was considered at several levels of consolidation and for both land and ocean disposal modes. As with other sparsely settled regions, major consolidation was not feasible. Environmental factors centered largely on the primary disposal modes considered; water balance factors (water quantity) were a governing consideration in this area and plans were rated higher when effluent disposal could be accommodated on land, particularly where a seasonal reuse of wastewater for irrigation could in effect replace water which could be supplied to other beneficial uses. Where percolation was to occur, particularly in winter, there is a problematical adverse impact on public health; however the small size of these discharges (the largest is 0.2 mgd) does not constitute a major contribution to groundwater. See Chapter 5 for discussion of State Department of Health guidelines concerning disposal to groundwater. Energy use was a factor in these plans since ocean disposal would require less energy than would land application which generally requires more pumping. Benefits of irrigation reuse and water balance favor land disposal and there are adverse impacts associated with ocean disposal to this scenic reach of coastline; however these are probably more social than ecological in view of the small volumes involved and constraints of the State Ocean Plan.

Further down the coast in the Morro Bay and Chorro Creek area the alternatives considered were similar in terms of the range of consolidation; however, disposal modes included stream discharge as well as land and ocean disposal. Ratings of alternatives described for this region are summarized in Table 17-3.

If no action is taken in the Morro Bay region various adverse impacts are expected; although many of these impacts may be mitigated by present regulation, the absence of a basin plan will make areawide controls more difficult to administer. For example, during rainy weather, runoff containing animal wastes from dairy farms along Chorro and Los Osos Creeks will continue to threaten the health of users of Morro Bay, persons who harvest shellfish and those who eat shellfish without adequate depuration or cooking. Pumping of groundwaters near Morro Bay at rates equalling or exceeding the present rate will induce intrusion of sea water into the ground-

Table 17-4 Environmental Evaluation San Luis Obispo Creek Area

ENVIRONMENTAL FACTORS	NO ACTION SLO[1]	NO ACTION ASD[1]	ALT I-OCEAN SLO	ALT I-OCEAN ASD	ALT II-OCEAN SLO	ALT II-OCEAN ASD	ALT II-STREAM SLO	ALT II-STREAM ASD	ALT II-SPRAY SLO	ALT II-SPRAY ASD
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL										
WATER										
1) SURFACE WATER QUALITY	●4	●	CONVEYED TO ASD	a●	a●	●	●	SPRAY IRRIGATION	●	●
2) SURFACE WATER QUANTITY	d●	●		●7	●7	●	d●		●7	●
3) GROUNDWATER QUALITY	●3	●		a●	a●	●	●		●3	●3
4) GROUNDWATER QUANTITY	c●	●		●6	●6	●6	c●		c●	c●
5) OCEAN WATER QUALITY	●5	●		●	●	●	●		a●	a●
LAND										
6) LAND FORMS; EROSION SILTATION	?	●		?	?	●	?		●	●
7) LAND QUALITY, SOIL PRODUCTIVITY	●	●		?	?	●	?		?	?
AIR										
8) ATMOSPHERE; AIR QUALITY	?	?		?	?		?		?	?
BIOLOGICAL										
9) SENSITIVE HABITATS	●8	●8		●8	●8	●8	d●		●7	a●
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●9	●9		●	●	●	d●		●7	●
11) FRESHWATER AND ANADROMOUS FISHERY	●10	●10		●7	●7	●	d●		●7	a●
12) MARINE FIN FISHERY	●8	●8		●8	●8	●8	●		a●	a●
13) MARINE INVERTEBRATE FISHERY	●8	●8		●8	●8	●8	●		a●	a●
SOCIAL										
14) RECREATION	●11	●11		●11	●11	●11	e●		●11	●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●		●	?	●	●		●	●
16) LAND USE, OPEN SPACE, DEVELOPMENT	●	●		●12	●12	●12	●12		●12	●12
17) PUBLIC HEALTH AND WELFARE	●13	●13		f●	f●	f●	f●		f●	f●
18) SOCIAL ACCEPTABILITY	●14	●14		g●	g●	g●	g●		g●	g●
19) POPULATION DENSITY, CONGESTION	●	●		●12	●12	●12	●12		●12	●12
AESTHETIC										
20) NOISE, ODOR	?	?		?	?	?	?		?	?
21) NATURAL SCENIC QUALITY	?	?		?	?	?	?		?	?
OVERALL RATING	D	D		C	C	A	A		C	B

FOOTNOTES:

SLO	CITY OF SAN LUIS OBISPO
ASD	AVILA SANITATION DISTRICT
1-14	ADVERSE IMPACT EXPLANATIONS
a-g	BENEFICIAL IMPACT EXPLANATIONS

KEY TO IMPACTS:

- ● BENEFICIAL (+)
- ● ADVERSE (-)
- ● NONE / NOT APPLICABLE
- ? PROBLEMATICAL

OVERALL RATINGS:

- A SUPERIOR
- B ACCEPTABLE
- C MARGINAL
- D UNACCEPTABLE

water basin. Untreated sewage could continue to overflow from pumping stations in Cayucos and in the City of Morro Bay during rainstorms, causing significant risk to the health of persons who might contact adjacent coastal waters of the Pacific Ocean. Drainage from septic tanks in Los Osos — Baywood area and wastewater discharged to the oxidation-percolation pond planned for construction by the state for the California Men's Colony would be expected to increase the nitrate concentration of groundwaters and add to the inflow of nitrogen to Morro Bay. The latter effect will increase the potential for stimulation of nuisance blooms of algae. Infiltration of irrigation return waters and of leachate from dairies in the area will contribute chlorides and nitrates to local groundwaters. Population growth in the Morro Bay-Cayucos service area will cause the capacity of treatment facilities to be exceeded in the late 1980's resulting in risk of pollution deleterious to beneficial uses of receiving waters. Flooding of Chorro Creek will impair wastewater treatment and disposal operations at the California Men's Colony plant and may cause discharge of raw sewage to the creek with consequent risk to public health.

Ratings of the three consolidation levels for the Morro Bay Region, described as Alternatives I, II and III in Chapter 16, differ more in terms of disposal options provided than in their consolidation aspects. Major differences occur between land and stream or ocean disposal options. Generally these ratings favor land disposal since treatment can be provided which eliminates concerns over nitrates and irrigation reuse helps maintain water balance. Substitution of wastewater for irrigation pumping is considered desirable since this avoids problematical public health questions caused by percolation of large quantities of wastewater effluent to groundwater. Surface water disposal to Chorro Creek, upstream of Morro Bay, despite level VI treatment was rated as slightly adverse since Morro Bay is considered an ecologically sensitive area. See Chapter 6 for discussion of resources dependent on this habitat. There is a prohibition of direct discharge to Morro Bay in the State Bays and Estuaries policy; discharge to Chorro Creek immediately upstream of the tidal area can be viewed as a violation of the goals of this policy. Accordingly alternative III, option 2, which describes a separation of facilities employing land disposal with emphasis on seasonal irrigation reuse received the higher environmental ratings. The Los Osos Baywood area is encouraged to conduct sewerage feasibility studies for their area; however, once a sewering program is implemented separate land disposal is recommended; see Chapter 5.

In the San Luis Obispo Creek area the evaluation of alternatives described in Chapter 16 is subject to debate depending on the extent of habitat protection desired downstream in an impoundment near Avila Beach versus the value of retaining year-round flow in the stream. This dilemma is considered in more detail in Chapter 15 and is addressed in staging considerations and studies described in the implementation plan and assessed in Chapter 6. Levels of consolidation considered in Chapter 16 are evaluated from an environmental standpoint in Table 17-4.

If no action is taken in the San Luis Obispo Creek region the following impacts are expected. Excessive inflows of stormwaters to the sewer system will continue to cause discharge of untreated sewage from the influent pumping station of the City of San Luis Obispo wastewater treatment plant to San Luis Obispo Creek and partially treated sewage from the city's treatment plant to the creek, resulting in risk of pollution deleterious to beneficial uses of receiving waters. Flooding of San Luis Obispo Creek would impair operation of the San Luis Obispo treatment plant and cause discharge of raw sewage to the creek with consequent risk to public health. Maintenance of the present treatment facilities will cause violation of recommended objectives for nitrogen and phosphorous for control of eutrophication downstream. Lack of auxiliary power supply at the Avila Sanitary District and San Luis Obispo treatment plants and lack of duplicate process units at the Avila SD plant will allow risk of plant failure with consequent pollution deleterious to beneficial uses of receiving waters and hazardous to public health. It is possible that the discharge of the Avila Sanitary District plant will violate effluent and dilution requirements of the State Ocean Plan.

No action is unacceptable in this region, and the alternatives described in Chapter 16 each provide for more acceptable water quality control. Nonpoint pollution controls are needed in this region to make water quality benefits due to point source controls possible. Alternative II with stream disposal is the preferred alternative for the city of San Luis Obispo whereas Alternative II with ocean disposal is preferred for Avila Beach. The primary differences between alternative ratings reflect the poorer soil conditions for irrigation disposal in the area around San Luis Obispo and lack of suitable sites near Avila Beach except where seasonal use is employed. Stream quality improvement is apparent with level VI treatment, provided non-point controls are enforced. Ocean water quality could benefit from improvements at Avila Beach but effects on water quality may not be measurable.

The South County Region alternatives do not differ markedly except in their economic aspects, reflecting differing degrees of consolidation. Ocean disposal is the only viable option for this area and the small volumes of wastewater involved (less than 4 mgd) do not indicate any significant impacts would occur off these sandy beach areas. Disinfection is an essential aspect of each plan since recreation uses and shellfish habitats are important in this coastal area, see Chapter 6.

No action is unacceptable since existing outfall facilities are not adequate, see Chapter 16. However, it is probable that the facility improvements suggested in the plan and deficiencies noted in Chapter 16, such as ocean outfall inadequacies, would be corrected through implementation of the State Ocean Plan. Accordingly, the lack of a basin plan for this area would not be as serious as in most areas of the basin since areawide controls including facility consolidation and nonpoint controls are less important considerations in this area. Consolidation of outfall facilities between Pismo Beach and South San Luis Obispo is encouraged but not considered a requirement for effective environmental control.

The rating of environmental factors for alternatives for the coastal reach described in Chapter 16 is generally similar for ocean disposal options; percolation options are not considered environmentally sound unless nitrate removal is included. Alternatives reflecting differing degrees of consolidation are considered essentially equal from an environmental standpoint although conveyance impacts would be greater for Alternative I which conveys Avila Beach wastewater to Pismo Beach or where joint outfall facilities are shared under Alternative II.

The situation at the Lopez recreation area requires upgrading of plant reliability to correct deficiencies noted in Chapter 16. This area is considered at "carrying capacity" and added waste loads are not really likely to occur in this area. No action, in terms of basin planning, would not create a serious problem inasmuch as upgrading of plant reliability is required by present regulatory activity.

Soda Lake Sub-Basin

There are no municipal or industrial wastewater facilities in this sub-basin and none are expected to be required; consequently there are no alternative wastewater management plans to be evaluated here for point sources. Considerations of nonpoint sources pertain to this area; these are discussed in Chapters 5, 6 and 16.

Santa Maria River Sub-Basin

Under the "no action" alternative there are various kinds of environmental impacts which pertain to water quality; in general these are related to nonpoint source effects from agricultural activities and groundwater quality degradation caused by excessive mineralization of municipal wastewaters which are disposed of to land. For example, without more controls, overgrazing in the lowlands of the Santa Maria Valley will continue to aggravate erosion and siltation problems; feedlot operations on Nipomo Mesa with presently undersized check dams will continue to impart leachate from corrals, and manure stockpiles to Los Berros Creek during surface runoff periods; irrigation return waters will continue to contribute substantially to nitrate concentrations violating drinking water standards in localized areas of the groundwater basin. There will be some greater risk that disposal of oil field waste in the Cat Canyon area may contaminate groundwaters of adjacent aquifers. Residual municipal wastewater disposal, percolation of highly mineralized wastewater from disposal ponds of the City of Santa Maria, will continue to contribute to localized nitrate and salt buildup in groundwaters. Lack of auxiliary power at treatment plants of the Santa Maria Airport and the City of Santa Maria and of duplicate process units at plants of the Santa Maria Airport and City of Guadalupe will allow greater risk of operational failure with consequent pollution deleterious to beneficial use of receiving waters. That risk is aggravated by a general state of disrepair of equipment at the plants. Lack of a duplicate anaerobic digester at the City of Guadalupe plant will allow a significant risk of incidences of odorous conditions and water pollution associated with improper disposal of sludge during plant upsets. That risk is aggravated by the inadequacy of ancillary equipment to provide proper mixing of sludge. Concentrations of TDS, sodium and chloride in the effluent of the City of Santa Maria plant will continue to violate Regional Board discharge requirements. Effluent of Nipomo and septic tanks may cause slight degradation of groundwater quality and cause hazard to health of persons who contact receiving surface waters.

Several alternatives are available for the Cuyama Valley region. If no action is taken the effluent of the Cuyama Valley Community Services, Inc. will likely degrade quality to cause loss of beneficial uses of surface water and groundwater, and will cause hazard to health of persons who contact receiving surface waters.

Alternatives for the Santa Maria Valley and the Cuyama Region are described in Chapter 16. In the Santa Maria Valley Region there are possibilities for municipal wastewater facility consolidation; effluent disposal possibilities include discharge to ocean or land, however, improvements to effluent mineral quality are considered necessary for environmentally effective land disposal. The land disposal options considered in Chapter 16 include consideration of effluent demineralization or water supply improvements to effect necessary salt load reductions necessary to protect local groundwater quality.

Table 17-5 includes an environmental rating of consolidation alternatives and disposal options considered in the final economic and functional ratings of alternatives in Chapter 16. As can be seen in the table the various percolation and spray irrigation options are considered comparable and are rated over the ocean disposal mode; consolidation levels did not influence environmental ratings. No plan alternative or disposal option was rated as superior in this region, however, the percolation and irrigation disposal modes, which include salinity reduction, are rated as acceptable. Accordingly the environmental impact ratings in this area did not influence plan selection as heavily as did economic and functional factors since in each land disposal case the provisions for environmental quality protection were essentially equal. There is some advantage to maintenance of separate facilities for land disposal since this lessens concerns over excessive recharge with waters of sewage origin to local groundwaters relative to recharge of natural waters; see earlier discussions of land disposal impacts and State Department of Health guidelines in Chapters 5 and 6.

The Cuyama Region environmental impacts are similar to those described for land disposal generally with further emphasis given to the groundwater quality question since local groundwaters are of poor quality. Alternatives considered in Chapter 16 each address this problem; consequently environmental implications of action alternatives do not differ in any substantial way. General considerations of land disposal referred to earlier apply in this region.

San Antonio Creek Sub-Basin

There are no municipal or industrial wastewater facilities in this sub-basin and none are expected to be required. Consequently there are no alternative wastewater management plans to be evaluated here for point sources. Considerations of nonpoint sources pertain to this area; these are discussed in Chapters 5, 6 and 16.

Santa Ynez River Sub-Basin

Under the no action alternative there are various kinds of environmental impacts which can be expected; some of these pertain to a greater extent if there is no basin plan; however many of the deficiencies requiring correction would be implemented through Regional Board actions without a basin plan. For example the lack of auxiliary power supply at the Vandenberg Air Force Base plant and duplicate process units at the Vandenberg Air Force Base and the Federal Correctional Institute facilities will allow a risk of operational failure with consequent pollution deleterious to beneficial uses of receiving waters and hazardous to public health; the discharge of the Vandenberg Air Force Base plant will violate dilution requirements of the State Ocean Plan; this outfall has been lost; inadequacy of digester mixing equipment at plants of the Federal Correctional Institute and the City of Lompoc will allow a significant risk of incidence of odorous conditions.

Environmental assessments of alternatives for the Santa Ynez River Sub-basin differ primarily between disposal modes; a summary of ratings for the Lompoc Valley Region is provided in Table 17-6 to illustrate these differences. The greatest differences occur between the alternatives for the Vandenberg Air Force Base where ocean disposal is rated as an acceptable method in contrast to stream disposal for this discharge. Water quality protection is a major difference for the air force base, and in this case ocean disposal is considered as having a negligible impact compared with moderately adverse effects of stream disposal. In the case of Lompoc a slightly adverse impact is registered for stream disposal; however considering the percolation of effluent in the river reach below the plant this effect is probably negligible. No alternative for this area received a

Table 17-5 Environmental Evaluation Santa Maria Valley Region

ENVIRONMENTAL FACTORS	NO ACTION					ALT I - OCEAN					ALT I - PERC					ALT II - PERC				
PHYSICAL / CHEMICAL	GUAD[1]	SM[1]	SMPA	LCSD[1]	NIP[1]	GUAD	SM	SMPA	LCSD	NIP	GUAD	SM	SMPA	LCSD	NIP	GUAD	SM	SMPA	LCSD	NIP
WATER	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
1) SURFACE WATER QUALITY	●4	●4	●4	●4	?	a●					a●					●	●			?
2) SURFACE WATER QUANTITY	d●	d●	d●	d●	●	●7					●7					●7	●			●
3) GROUNDWATER QUALITY	●3	●3	●3	●3	●3	a ●					●3					●3	●3			●3
4) GROUNDWATER QUANTITY	c●	c●	c●	c●	●	●6					?					c●	c●			c●
5) OCEAN WATER QUALITY	●5	●	●	●	●	●2					a●					a●	●			●
LAND																				
6) LAND FORMS; EROSION SILTATION	?	?	?	?	?	●					●					?	?			?
7) LAND QUALITY, SOIL PRODUCTIVITY	?	?	?	?	?	●					●					?	?			?
AIR																				
8) ATMOSPHERE; AIR QUALITY	?	?	?	?	●	?					?					?	?			?
BIOLOGICAL																				
9) SENSITIVE HABITATS	●8	●	?	?	●	●8,7					●					●	●			●
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	●	?	?	●	●	CONVEYED TO GUAD	CONVEYED TO GUAD	CONVEYED TO GUAD	CONVEYED TO GUAD	●	CONVEYED TO GUAD	CONVEYED TO GUAD	CONVEYED TO GUAD	CONVEYED TO GUAD	●	●	CONVEYED TO SM	SPRAY IRRIGATION	●
11) FRESHWATER AND ANADROMOUS FISHERY	●10	●	?	?	●	●7					●					●	●			●
12) MARINE FIN FISHERY	●8	●	●	●	●	●8					●					●	●			●
13) MARINE INVERTEBRATE FISHERY	●8	●	●	●	●	●8					●					●	●			●
SOCIAL																				
14) RECREATION	●11	●	?	?	?	●11					●					●	●			●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●	●	●	●	●					●					●	●			●
16) LAND USE, OPEN SPACE, DEVELOPMENT	●	●	●	●	●	●12					●12					●12	●12			●12
17) PUBLIC HEALTH AND WELFARE	●13	●13	●13	●13	●13	●13					f●					f●	f●			f●
18) SOCIAL ACCEPTABILITY	●14	●14	●14	●14	●	●14					●14					g●	g●			g●
19) POPULATION DENSITY, CONGESTION	●	●	●	●	●	●12					●12					●12	●12			●12
AESTHETIC																				
20) NOISE, ODOR	?	?	?	?	?	?					?					?	?			?
21) NATURAL SCENIC QUALITY	●	?	?	?	?	?					?					?	?			?
OVERALL RATING	D	D	D	D	D	D					C					B	B			B

ENVIRONMENTAL FACTORS	ALT II - SPRAY					ALT III - OCEAN					ALT III - PERC					ALT III - SPRAY				
PHYSICAL / CHEMICAL	GUAD	SM	SMPA	LCSD	NIP	GUAD	SM	SMPA	LCSD	NIP	GUAD	SM	SMPA	LCSD	NIP	GUAD	SM	SMPA	LCSD	NIP
WATER	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
1) SURFACE WATER QUALITY	●			●			●				●	●			?	●		●	●	●
2) SURFACE WATER QUANTITY	●			●			●				●7	●			●	●		●	●	●
3) GROUNDWATER QUALITY	●3			●3			a●				●3	●3			●3	●3		●3	●3	●3
4) GROUNDWATER QUANTITY	c●			c●			●6				c●	c●			c●	c●		c●	c●	c●
5) OCEAN WATER QUALITY	a●			●			●2				a●	●			●	a●		●	●	●
LAND																				
6) LAND FORMS; EROSION SILTATION	?			?			●				●	?			●	●		●	●	●
7) LAND QUALITY, SOIL PRODUCTIVITY	?			?			●				●	?			●	●		●	●	●
AIR																				
8) ATMOSPHERE; AIR QUALITY	?			?			?				?	?			?	?		?	?	?
BIOLOGICAL																				
9) SENSITIVE HABITATS	●			●			●8				●	●			●	●		●	●	●
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	PERCOLATION	CONVEYED TO SM	●	PERCOLATION	PERCOLATION OR SPRAY	●	SPRAY IRRIGATION	SPRAY IRRIGATION	SPRAY IRRIGATION OR PERCOLATION	●	●	SPRAY IRRIGATION	SPRAY IRRIGATION	●	●	OCEAN DISPOSAL OR PERCOLATION	●	●	●
11) FRESHWATER AND ANADROMOUS FISHERY	●			●			●				●	●			●	●		●	●	●
12) MARINE FIN FISHERY	●			●			●8				●	●			●	●		●	●	●
13) MARINE INVERTEBRATE FISHERY	●			●			●8				●	●			●	●		●	●	●
SOCIAL																				
14) RECREATION	●			●			●11				●	●			●	●		●	●	●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●			●			●				●	●			●	●		●	●	●
16) LAND USE, OPEN SPACE, DEVELOPMENT	●12			●12			●12				●12	●12			●12	●12		●12	●12	●12
17) PUBLIC HEALTH AND WELFARE	f●			f●			f●				f●	f●			f●	f●		f●	f●	f●
18) SOCIAL ACCEPTABILITY	g●			g●			g●				g●	g●			g●	g●		g●	g●	g●
19) POPULATION DENSITY, CONGESTION	●12			●12			●12				●12	●12			●12	●12		●12	●12	●12
AESTHETIC																				
20) NOISE, ODOR	?			?			?				?	?			?	?		?	?	?
21) NATURAL SCENIC QUALITY	?			?			?				?	?			?	?		?	?	?
OVERALL RATING	B			B			D				B	B			B	B		B	B	B

FOOTNOTES:
GUAD CITY OF GUADALUPE
SM CITY OF SANTA MARIA
SMPA SANTA MARIA PUBLIC AIRPORT
LCSD LAGUNA COUNTY SANITATION DISTRICT
NIP NIPOMO
1-14 ADVERSE IMPACT EXPLANATIONS SEE NEXT PAGE
a-g BENEFICIAL IMPACT EXPLANATIONS SEE NEXT PAGE

KEY TO IMPACTS
BENEFICIAL (+)
ADVERSE (—)
● NONE / NOT APPLICABLE
? PROBLEMATICAL

OVERALL RATINGS
A SUPERIOR
B ACCEPTABLE
C MARGINAL
D UNACCEPTABLE

superior environmental rating; however, implementation plans were judged acceptable in contrast to other alternatives which were either marginal or unacceptable.

The upper Santa Ynez Region including the Buellton-Solvang area alternatives involve different levels of consolidation, however each envisions disposal by percolation; spray disposal may be encouraged during dry seasons. Each alternative was environmentally acceptable and though the general question of groundwater quality degradation must be addressed the facility plan alternatives described in Chapter 16 are essentially equal environmentally. The greatest consolidation, under Alternative I was rated slightly below the other action alternatives partly because of greater conveyance impacts and partly because groundwater percolation, which would be more locally intensive near Buellton, could have a greater risk than with several smaller isolated disposal sites. This point has been discussed under the Santa Maria River Sub-basin and in preceding chapters. The salt source control problem is evident in this region, and groundwater protection will require effective salt controls. These are discussed in Chapter 16 and are part of the implementation plan. Environmental ratings for Alternatives II and III for the upper Santa Ynez plans were judged superior.

Santa Barbara Coastal Sub-Basin

The Santa Barbara Coastal Sub-basin area wastewater management programs will not be seriously affected by a no action plan since most of the facilities in this area are being upgraded in response to earlier regulatory agency actions. Deficiencies noted in Chapter 16 are being corrected by projects which are for the most part committed to design or construction. Aspects of the State Ocean Plan influenced earlier formulation of projects in this area.

Evaluation of the alternatives described in Chapter 16 resulted in superior environmental ratings for stream and percolation disposal options of Alternative V for all discharges having these options and for separate ocean disposal for the small discharges at Montecito and Summerland. See Table 17-7. The stream and percolation options are rated above ocean disposal for the larger discharges primarily because of increased water quality and benefits to fish and wildlife habitats obtained through reclamation aspects of alternatives for the implementation plan was judged acceptable for the large dischargers and was considered as having negligible water quality impact as compared with the reclamation option of Alternative V which were rated slightly adverse for water quality factors. Accordingly, the selection of ocean disposal was made on the basis that this was the most acceptable water quality control plan despite higher overall ratings given for reclamation oriented plans. As with the Salinas-Monterey area, the plan selected is of necessity directed first toward water quality control although future reclamation features are not precluded by the plan.

Several possible wastewater reclamation possibilities were identified in the basin plan and are mentioned in Chapter 16 and in preceding chapters. Recommended actions for the State Water Resources Control Board and recommended legislation described in Chapter 5 also emphasize a need to encourage water quality control programs which provide total water management and that grant support should be made available for such programs which supplement irrigation programs. These recommendations would be particularly applicable to water-short areas such as the Santa Barbara Coastal Sub-basin.

Table 17-6 Environmental Evaluation Lompoc Valley Region

ENVIRONMENTAL FACTORS	NO ACTION			ALT I-OCEAN *			ALT I-STREAM			ALT I-SPRAY			ALT II-OCEAN		
	VAFB'	FCI'	LOM'	VAFB	FCI	LOM	VAFB	FCI	LOM	VAFB	FCI	LOM	VAFB'	FCI'	LOM'
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
					CONVEYED TO LOM	STREAM DISPOSAL		CONVEYED TO LOM			CONVEYED TO LOM	STREAM DISPOSAL		STREAM DISPOSAL OR SPRAY IRRIGATION	STREAM DISPOSAL
PHYSICAL / CHEMICAL															
WATER															
1) SURFACE WATER QUALITY	●	●4	●4	●			●4		●4	?			●		
2) SURFACE WATER QUANTITY	●	d●	d●	●			d●		d●	?			●		
3) GROUNDWATER QUALITY	●	●3	●3	●			●3		●3	●3			●		
4) GROUNDWATER QUANTITY	●	c●	c●	●			c●		c●	c●			●		
5) OCEAN WATER QUALITY	●2	●5	●5	●2			●2		●2	●			●5		
LAND															
6) LAND FORMS; EROSION SILTATION	●	?	?	●			?		?	?			●		
7) LAND QUALITY, SOIL PRODUCTIVITY	●	?	?	●			?		?	?			●		
AIR															
8) ATMOSPHERE; AIR QUALITY	?	?	?	?			?		?	?			?		
BIOLOGICAL															
9) SENSITIVE HABITATS	●8	●8	●8	●8			●8		●8	a●			●8		
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	?	?	?	●			?		?	●			?		
11) FRESHWATER AND ANADROMOUS FISHERY	●	●10	●10	●			●10		●10	●			●		
12) MARINE FIN FISHERY	●8	●8	●8	●8			●		●	a●			●8		
13) MARINE INVERTEBRATE FISHERY	●8	●8	●8	●8			●8		●	a●			●8		
SOCIAL															
14) RECREATION	●11	●11	●11	●11			●11		●11	e●			●11		
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●	●	●			●		●	?			●		
16) LAND USE, OPEN SPACE, DEVELOPMENT	●	●	●	●12			●12		●12	●12			●12		
17) PUBLIC HEALTH AND WELFARE	●13	●13	●13	f●			●13		f●	f●			f●		
18) SOCIAL ACCEPTABILITY	●14	●14	●14	g●			●14		g●	g●			g●		
19) POPULATION DENSITY, CONGESTION	●	●	●	●12			●12		●12	●12			●12		
AESTHETIC															
20) NOISE, ODOR	?	?	?	?			?		?	?			?		
21) NATURAL SCENIC QUALITY	?	?	?	?			?		?	?			?		
OVERALL RATING	D	D	D	B			D		B	C			B		

ENVIRONMENTAL FACTORS	ALT II - STREAM			ALT II - SPRAY		
	VAFB	FCI	LOM	VAFB	FCI	LOM
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
						STREAM DISPOSAL
PHYSICAL / CHEMICAL						
WATER						
1) SURFACE WATER QUALITY	●4	●4	●4	?	?	
2) SURFACE WATER QUANTITY	d●	d●	d●	?	?	
3) GROUNDWATER QUALITY	●3	●3	●3	●3	●3	
4) GROUNDWATER QUANTITY	c●	c●	c●	c●	c●	
5) OCEAN WATER QUALITY	●2	●2	●2	●	●	
LAND						
6) LAND FORMS; EROSION SILTATION	?	?	?	?	?	
7) LAND QUALITY, SOIL PRODUCTIVITY	?	?	?	?	?	
AIR						
8) ATMOSPHERE; AIR QUALITY	?	?	?	?	?	
BIOLOGICAL						
9) SENSITIVE HABITATS	●8	●8	●8	a●	a●	
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	?	?	?	●	●	
11) FRESHWATER AND ANADROMOUS FISHERY	●10	●10	●10	●	●	
12) MARINE FIN FISHERY	●	●	●	a●	a●	
13) MARINE INVERTEBRATE FISHERY	●8	●	●	a●	a●	
SOCIAL						
14) RECREATION	●11	●11	●11	e●	e●	
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●	●	?	?	
16) LAND USE, OPEN SPACE, DEVELOPMENT	●12	●12	●12	●12	●12	
17) PUBLIC HEALTH AND WELFARE	●13	f●	f●	f●	f●	
18) SOCIAL ACCEPTABILITY	●14	g●	g●	g●	g●	
19) POPULATION DENSITY, CONGESTION	●12	●12	●12	●12	●12	
AESTHETIC						
20) NOISE, ODOR	?	?	?	?	?	
21) NATURAL SCENIC QUALITY	?	?	?	?	?	
OVERALL RATING	D	B	B	C	C	

FOOTNOTES:

VAFB VANDENBERG AIR FORCE BASE
FCI FEDERAL CORRECTIONAL INSTITUTION
LOM CITY OF LOMPOC

* RECOMMENDED PLAN

1 - 14 ADVERSE IMPACT EXPLANATIONS SEE NEXT PAGE

a - g BENEFICIAL IMPACT EXPLANATIONS SEE NEXT PAGE

KEY TO IMPACTS

● BENEFICIAL (+)
● ADVERSE (-)
● NONE / NOT APPLICABLE
? PROBLEMATICAL

OVERALL RATINGS

A SUPERIOR
B ACCEPTABLE
C MARGINAL
D UNACCEPTABLE

Table 17-7 Environmental Evaluation Santa Barbara Coastal Region

ENVIRONMENTAL FACTORS	NO ACTION					ALT I - OCEAN				
	GSD[1]	SBA[1]	MSD[1]	SSD[1]	CSD[1]	GSD	SBA	MSD	SSD	CSD
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL										
WATER										
1) SURFACE WATER QUALITY	●	●	●	●	●	●	●			
2) SURFACE WATER QUANTITY	●	●	●	●	●	●	●			
3) GROUNDWATER QUALITY	●	●	●	●	●	●	●			
4) GROUNDWATER QUANTITY	● 6	● 6	● 6	● 6	● 6	● 6	● 6			
5) OCEAN WATER QUALITY	● 2	● 2	● 2	● 2	● 2	● 2	● 2			
LAND										
6) LAND FORMS; EROSION SILTATION	●	●	●	●	●	●	●			
7) LAND QUALITY, SOIL PRODUCTIVITY	●	●	●	●	●	●	●			
AIR										
8) ATMOSPHERE; AIR QUALITY	?	?	?	?	?	?	?			
BIOLOGICAL										
9) SENSITIVE HABITATS	● 8	● 8	● 8	● 8	● 8	● 8	● 8			
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	●	●	●	●	●	●	CONVEYED TO SBA	CONVEYED TO SBA	CONVEYED TO SBA
11) FRESHWATER AND ANADROMOUS FISHERY	●	●	●	●	●	●	●			
12) MARINE FIN FISHERY	● 8	● 8	● 8	● 8	● 8	● 8	● 8			
13) MARINE INVERTEBRATE FISHERY	● 8	● 8	● 8	● 8	● 8	● 8	● 8			
SOCIAL										
14) RECREATION	● 11	● 11	● 11	● 11	● 11	● 11	● 11			
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●	●	●	●	●	?	●			
16) LAND USE, OPEN SPACE, DEVELOPMENT	●	●	●	●	●	● 12	● 12			
17) PUBLIC HEALTH AND WELFARE	● 13	● 13	● 13	● 13	● 13	f●	● 13			
18) SOCIAL ACCEPTABILITY	● 14	● 14	● 14	● 14	● 14	g●	● 14			
19) POPULATION DENSITY, CONGESTION	●	●	●	●	●	● 12	● 12			
AESTHETIC										
20) NOISE, ODOR	?	?	?	?	?	?	?			
21) NATURAL SCENIC QUALITY	?	?	?	?	?	?	?			
OVERALL RATING	D	D	D	D	D	B	D			

ENVIRONMENTAL FACTORS	ALT II - OCEAN					ALT III - OCEAN					ALT IV - OCEAN				
	GSD	SBA	MSD	SSD	CSD	GSD	SBA	MSD*	SSD*	CSD	GSD	SBA	MSD	SSD	CSD
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL															
WATER															
1) SURFACE WATER QUALITY	●	●			●	●	●	?	?	●	●	●	●		●
2) SURFACE WATER QUANTITY	●	●			●	●	●	*●	*●	●	●	●	●		●
3) GROUNDWATER QUALITY	●	●			●	●	●	?	?	●	●	●	●		●
4) GROUNDWATER QUANTITY	● 6	● 6			● 6	● 6	● 6	?	?	● 6	● 6	● 6	● 6		● 6
5) OCEAN WATER QUALITY	● 2	● 2			● 2	● 2	● 2	a●	a●	● 2	● 2	● 2	● 2		● 2
LAND															
6) LAND FORMS; EROSION SILTATION	●	●			●	●	●	?	?	●	●	●	●		●
7) LAND QUALITY, SOIL PRODUCTIVITY	●	●			●	●	●	?	?	●	●	●	●		●
AIR															
8) ATMOSPHERE; AIR QUALITY	?	?			?	?	?	?	?	?	?	?	?		?
BIOLOGICAL															
9) SENSITIVE HABITATS	● 8	● 8			● 8	● 8	● 8	a●	a●	● 8	● 8	● 8	● 8		● 8
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	●	CONVEYED TO SBA	CONVEYED TO SBA	●	●	●	?	?	●	●	●	●	CONVEYED TO MSD	●
11) FRESHWATER AND ANADROMOUS FISHERY	●	●			●	●	●	?	?	●	●	●	●		●
12) MARINE FIN FISHERY	● 8	● 8			● 8	● 8	● 8	a●	a●	● 8	● 8	● 8	● 8		● 8
13) MARINE INVERTEBRATE FISHERY	● 8	● 8			● 8	● 8	● 8	a●	a●	● 8	● 8	● 8	● 8		● 8
SOCIAL															
14) RECREATION	● 11	● 11			● 11	● 11	● 11	e●	e●	● 11	● 11	● 11	● 11		● 11
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	?	●			●	?	●	●	●	●	?	?	?		?
16) LAND USE, OPEN SPACE, DEVELOPMENT	● 12	● 12			● 12	● 12	● 12	?	?	● 12	● 12	● 12	● 12		● 12
17) PUBLIC HEALTH AND WELFARE	f●	● 13			f●	f●	f●	f●	f●	f●	f●	f●	f●		f●
18) SOCIAL ACCEPTABILITY	g●	● 14			g●	g●	g●	g●	g●	g●	g●	g●	g●		g●
19) POPULATION DENSITY, CONGESTION	● 12	● 12			● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12		● 12
AESTHETIC															
20) NOISE, ODOR	?	?			?	?	?	?	?	?	?	?	?		?
21) NATURAL SCENIC QUALITY	?	?			?	?	?	?	?	?	?	?	?		?
OVERALL RATING	B	D			B	B	B	A	A	B	B	B	B	B	B

ENVIRONMENTAL FACTORS	ALT V - OCEAN *					ALT V - STREAM				
	GSD	SBA	MSD	SSD	CSD	GSD	SBA	MSD	SSD	CSD
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL										
WATER										
1) SURFACE WATER QUALITY	●	●	●	●	●	● 4	● 4	● 4	● 4	● 4
2) SURFACE WATER QUANTITY	●	●	●	●	●	d●	d●	d●	d●	d●
3) GROUNDWATER QUALITY	●	●	●	●	●	● 3	● 3	● 3	● 3	● 3
4) GROUNDWATER QUANTITY	● 6	● 6	● 6	● 6	● 6	c●	c●	c●	c●	c●
5) OCEAN WATER QUALITY	● 2	● 2	● 2	● 2	● 2	?	?	?	?	?
LAND										
6) LAND FORMS; EROSION SILTATION	●	●	●	●	●	?	?	?	?	?
7) LAND QUALITY, SOIL PRODUCTIVITY	●	●	●	●	●	?	?	?	?	?
AIR										
8) ATMOSPHERE; AIR QUALITY	?	?	?	?	?	?	?	?	?	?
BIOLOGICAL										
9) SENSITIVE HABITATS	● 8	● 8	● 8	● 8	● 8	?	?	?	?	?
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●	●	●	●	●	d●	d●	d●	d●	d●
11) FRESHWATER AND ANADROMOUS FISHERY	●	●	●	●	●	d●	d●	d●	d●	d●
12) MARINE FIN FISHERY	● 8	● 8	● 8	● 8	● 8	?	?	?	?	?
13) MARINE INVERTEBRATE FISHERY	● 8	● 8	● 8	● 8	● 8	?	?	?	?	?
SOCIAL										
14) RECREATION	● 11	● 11	● 11	● 11	● 11	e●	e●	e●	e●	e●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	?	?	?	?	?	●	●	●	●	●
16) LAND USE, OPEN SPACE, DEVELOPMENT	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12
17) PUBLIC HEALTH AND WELFARE	f●	f●	f●	f●	f●	f●	f●	f●	f●	f●
18) SOCIAL ACCEPTABILITY	g●	g●	g●	g●	g●	g●	g●	g●	g●	g●
19) POPULATION DENSITY, CONGESTION	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12	● 12
AESTHETIC										
20) NOISE, ODOR	?	?	?	?	?	?	?	?	?	?
21) NATURAL SCENIC QUALITY	?	?	?	?	?	?	?	?	?	?
OVERALL RATING	B	B	B	B	B	A	A	A	A	A

ENVIRONMENTAL FACTORS	ALT V - PERC					ALT V - SPRAY				
	GSD	SBA	MSD	SSD	CSD	GSD	SBA	MSD	SSD	CSD
	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +	-10 -3 -1 0 +
PHYSICAL / CHEMICAL										
WATER										
1) SURFACE WATER QUALITY	●		●	●	●	?			?	?
2) SURFACE WATER QUANTITY	●		●	●	●	?			?	?
3) GROUNDWATER QUALITY	● 3		● 3	● 3	● 3	● 3			● 3	● 3
4) GROUNDWATER QUANTITY	c●		c●	c●	c●	c●			c●	c●
5) OCEAN WATER QUALITY	a●		a●	a●	a●	a●			a●	a●
LAND										
6) LAND FORMS; EROSION SILTATION	●		●	●	●	?			?	?
7) LAND QUALITY, SOIL PRODUCTIVITY	●		●	●	●	?			?	?
AIR										
8) ATMOSPHERE; AIR QUALITY	?		?	?	?	?		OCEAN, STREAM OR PERCOLATION DISPOSAL	?	?
BIOLOGICAL										
9) SENSITIVE HABITATS	a●		a●	a●	a●	a●			a●	a●
10) WILDLIFE RESOURCES, RARE OR ENDANGERED SPECIES	●		●	●	●	?			?	?
11) FRESHWATER AND ANADROMOUS FISHERY	●	OCEAN OR STREAM DISPOSAL	●	●	●	?	OCEAN OR STREAM DISPOSAL		?	?
12) MARINE FIN FISHERY	a●		a●	a●	a●	a●			a●	a●
13) MARINE INVERTEBRATE FISHERY	a●		a●	a●	a●	a●			a●	a●
SOCIAL										
14) RECREATION	e●		e●	e●	e●	e●			e●	e●
15) REGISTERED ARCHEOLOGICAL AND HISTORICAL SITES	●		●	●	●	●			●	●
16) LAND USE, OPEN SPACE, DEVELOPMENT	● 12		● 12	● 12	● 12	● 12			● 12	● 12
17) PUBLIC HEALTH AND WELFARE	f●		f●	f●	f●	f●			f●	f●
18) SOCIAL ACCEPTABILITY	g●		g●	g●	g●	g●			g●	g●
19) POPULATION DENSITY, CONGESTION	● 12		● 12	● 12	● 12	● 12			● 12	● 12
AESTHETIC										
20) NOISE, ODOR	?		?	?	?	?			?	?
21) NATURAL SCENIC QUALITY	?		?	?	?	?			?	?
OVERALL RATING	A		A	A	A	C			C	C

FOOTNOTES:
GSD GOLETA SANITARY DISTRICT
SBA CITY OF SANTA BARBARA
MSD MONTECITO SANITARY DISTRICT
SSD SUMMERLAND SANITARY DISTRICT
CSD CARPINTERIA SANITARY DISTRICT
* CONVERSION TO SATELLITE WASTEWATER RECLAMATION PLANTS, SOLIDS TREATED AT SBA
1-14 ADVERSE IMPACT EXPLANATIONS SEE NEXT PAGE
a-g BENEFICIAL IMPACT EXPLANATIONS SEE NEXT PAGE

KEY TO IMPACTS
● BENEFICIAL (+)
● ADVERSE (−)
● NONE / NOT APPLICABLE
? PROBLEMATICAL

OVERALL RATINGS
A SUPERIOR
B ACCEPTABLE
C MARGINAL
D UNACCEPTABLE

Significant Unavoidable Adverse Impacts

1. Presently existing wastewater treatment and disposal facilities have inadequate capacity to accommodate the increase in wastewater volume which will be generated by the increase in population and economic development.

2. Present discharges of primary and projected future discharges of Class II primary or secondary wastewater to the ocean will degrade the local marine environment.

3. Wastewater infiltration will cause dissolved solids and nitrate levels to incrementally increase in the underlying groundwater basin.

4. Oxygen demanding wastes, biostimulatory and toxic substances may enter the cold freshwater environment of the adjacent creek. Coastal streams have a limited capacity to assimilate such waste materials.

5. Diluted waste will enter critical and highly sensitive coastal wetlands either directly, by seepage or by tributary streams.

6. Groundwater recharge capacity will be lost.

7. Streamflow augmentation capacity will be lost.

8. Sensitive marine and estuarine biological communities will be impacted by the discharge of wastewater. Examples of vulnerable biotic features of these systems include the kelp bed community (which may be eliminated or reduced in size by treated wastewaters) and shellfish (which may accumulate pathogenic bacteria, heavy metals, and organic toxicants).

9. A rare or endangered species is fully or partially dependent upon the receiving water environment.

10. Degradation of the cold freshwater environment by biostimulatory and toxic waste materials may have an adverse impact on resident and anadromous fish, fish migration and spawning habitat.

11. Recreational uses which are dependent upon the quality of fishing, swimming, skin diving, clamming, bird watching, etc. will be adversely impacted to the same degree as the resources upon which they are based are impacted or to the extent that aesthetic qualities are impaired.

12. The construction of additional interceptor sewers which link communities and land developable for residential and commercial purposes to waste treatment plants will provide an opportunity for such development to occur wherever trunk sewers may tie in. Although this potential growth-inducing impact may be eliminated by strict zoning ordinances or limitation of pipe sizing, such measures are not always present or successful. Regardless of the desirability of such growth, the resulting conversion of agricultural or open land for other uses and the increase in population density and congestion are judged to be an adverse environmental impact.

13. The public health and welfare are threatened by inadequate treatment of wastewaters, consequent water quality problems, and impairment of the beneficial uses of basin waters.

14. The public view of the nature and magnitude of the adverse impacts, the social desirability, and acceptability of the alternative is considered low.

Beneficial Impacts

a. The quality of the receiving water will be improved because a wastewater discharge is eliminated. Benefits are achieved for the biological systems of surface and ocean waters.

b. The quality of the receiving water will be improved because a higher level of treatment is provided. Benefits are achieved for the biological systems of surface and ocean waters.

c. Groundwater recharge will be provided.

d. Streamflow augmentation will be provided. As a result, benefits are achieved for the biological system (including reparian habitat).

e. Recreational uses which are dependent upon resources receiving benefits are similarly enhanced.

f. The public health and welfare are improved because water quality problems are eliminated or mitigated by appropriate levels of treatment and the beneficial uses of basin waters are thereby protected.

g. After weighing the nature and magnitude of the recognized adverse impacts in contrast to the beneficial impacts which are achieved, the plan is judged to be desirable and acceptable to the regional population as a whole.

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PART IV. GLOSSARY OF TERMS

GLOSSARY OF TERMS

FOREWORD

The terms used and defined in this text are those generally associated with water quality or water resources management. For the most part the terms have been taken from the "Glossary – Water and Wastewater Control Engineering" published jointly by APHA, ASCE, AWWA and WPCF.

These terms are used regularly or have special meaning in water quality control work and have been collected together in one volume as a matter of convenience to the user. It may be necessary at times to consult other source books for terms not included.

ABS	Customary abbreviation of sodium alkyl benzene sulfonate (hard detergent).
ABAG	Association of Monterey Bay Area Governments consisting of Monterey, Santa Cruz and San Benito Counties and most of the incorporated cities in those counties.
Acre-foot	(1) A volume of water 1 ft deep and 1 acre in area, or 43,560 cu ft. (2) A 43,560-cu ft. volume of trickling filter medium.
Activated Sludge	Sludge floc produced in raw or settled wastewater by the growth of zoogleal bacteria and other organisms in the presence of dissolved oxygen and accumulated in sufficient concentration by returning floc previously formed.
Activated Sludge Process	A biological wastewater treatment process in which a mixture of wastewater and activated sludge is agitated and aerated. The activated sludge is subsequently separated from the treated wastewater (mixed liquor) by sedimentation and wasted or returned to the process as needed.
ADWF	Average dry weather flow.
Aeration	(1) The bringing about of intimate contact between air and a liquid by one or more of the following methods: (a) spraying the liquid in the air, (b) bubbling air through the liquid, (c) agitating the liquid to promote surface absorption of air. (2) The supplying of air to confined spaces under nappes, downstream from gates in conduits, etc., to relieve low pressures and to replenish air entrained and removed from such confined spaces by flowing water. (3) Relief of the effects of cavitation by admitting air to the section affected.
Aeration Tank	A tank in which sludge, wastewater, or other liquid is aerated.
Aerator	A device that promotes aeration.
Aerobic	Requiring, or not destroyed by, the presence of free elemental oxygen.

Aerobic Digestion — Digestion of suspended organic matter by means of aeration. See digestion.

Algae — Primitive plants, one-or many-celled, usually aquatic, and capable of elaborating their foodstuffs by photosynthesis.

Algal Bloom — Large masses of microscopic and macroscopic plant life, such as green algae, occurring in bodies of water.

Alkali — Any of certain soluble salts, principally of sodium, potassium, magnesium, and calcium, that have the property of combining with acids to form neutral salts and may be used in chemical processes such as water or wastewater treatment.

Aquatic Growth — The aggregate of passively floating or drifting or attached organisms in a body of water; plankton.

Aquifer — A porous, water-bearing geologic formation. Generally restricted to materials capable of yielding an appreciable supply of water.

Artificial Recharge — Replenishment of the groundwater supply by means of spreading basins, recharge wells, irrigation, or induced infiltration of surface water.

Assimilative Capacity — The capacity of a natural body of water to receive: (a) wastewaters, without deleterious effects; (b) toxic materials, without damage to aquatic life or humans who consume the water; (c) BOD, within prescribed dissolved oxygen limits.

Available Dilution — The ratio of the quantity of untreated wastewater or partly or completely treated effluent to the average quantity of diluting water available, effective at the point of disposal or at any point under consideration; usually expressed in percentage. Also called dilution factor.

Available Oxygen — The quantity of dissolved oxygen available for oxidation of organic matter in a water body.

Average Daily Flow — The total quantity of liquid tributary to a point divided by the number of days of flow measurement.

Bacteria — A group of universally distributed, rigid, essentially unicellular microscopic organisms lacking chlorophyll. Bacteria usually appear as spheroid, rod-like, or curved entities, but occasionally appear as sheets, chains, or branched filaments. Bacteria are usually regarded as plants.

Benthos — The aggregate of organisms living on or at the bottom of a body of water.

Bioassay — (1) An assay method using a change in biological activity as a qualitative or quantitative means of analyzing a meterial's response to biological treatment. (2) A method of determining toxic effects of industrial wastes and other wastewaters by using viable organisms or live fish as test organisms.

Biochemical Oxidation	An oxidation brought about by biological activity which results in chemical combination of oxygen with organic matter.
Biochemical Oxygen Demand	A standard test used in assessing wastewater strength. See BOD.
Biodegradation (Biodegradability)	The destruction or mineralization of either natural or synthetic organic materials by the microorganisms populating soils, natural bodies of water, or wastewater treatment systems.
Biological Oxidation	The process whereby living organisms in the presence of oxygen convert the organic matter contained in wastewater into a more stable or a mineral form.
Biological Wastewater Treatment	Forms of wastewater treatment in which bacterial or biochemical action is intensified to stabilize, oxidize, and nitrify the unstable organic matter present. Intermittent sand filters, contact beds, trickling filters, and activated sludge processes are examples.
Biota	Animal and plant life, or fauna and flora, of a stream or other water body.
Blowdown	The water discharged from a boiler or cooling tower to dispose of accumulated salts.
BOD	(1) Abbreviation for biochemical oxygen demand. The quantity of oxygen used in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. (2) A standard test used in assessing wastewater strength.
BOD Load	The BOD content, usually expressed in pounds per unit of time, of wastewater passing into a waste treatment system or to a body of water.
Bypass	An arrangement of pipes, conduits, gates, and valves whereby the flow may be passed around a hydraulic structure or appurtenance.
Chemical Treatment	Any process involving the addition of chemicals to obtain a desired result.
Chlorination	The application of chlorine to water or wastewater, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.
Clarifier	A unit of which the primary purpose is to secure clarification. Usually applied to sedimentation tanks or basins.

Coliform-Group Bacteria
A group of bacteria predominantly inhabiting the intestines of man or animal, but also occasionally found elsewhere. It includes all aerobic and facultative anaerobic, Gram-negative, non-spore-forming bacilli that ferment lactose with production of gas. Also included are all bacteria that produce a dark, purplish-green colony with metallic sheen by the membrane-filter technique used for coliform identification. The two groups are not always identical, but they are generally of equal sanitary significance.

Combined Sewer
A sewer intended to receive both wastewater and storm or surface water.

Combined Wastewater
A mixture of surface runoff and other wastewater such as domestic or industrial wastewater.

Contamination
Any introduction into water of microorganisms, chemicals, wastes, or wastewater in a concentration that makes the water unfit for its intended use.

Cubit Foot Per Second (cfs)
A unit of measure of the rate of liquid flow past a given point equal to one cubic foot in one second. Previously also called second-foot.

Dechlorination
The partial or complete reduction of residual chlorine in a liquid by any chemical or physical process.

Degree of Treatment
A measure of the removal effected by treatment processes with reference to solids, organic matter, BOD, bacteria, or any other specified matter.

Detention Time
The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).

Digested Sludge
Sludge digested under either aerobic or anaerobic conditions until the volatile content has been reduced to the point at which the solids are relatively nonputrescible and inoffensive.

Digestion
(1) The biological decomposition of organic matter in sludge, resulting in partial gasification, liquefaction, and mineralization. (2) The process carried out in a digester. See sludge digestion.

Dilution
Disposal of wastewater or treated effluent by discharging it into a stream or body of water.

Dilution Factor
The ratio of the quantity of untreated wastewater or partly or completely treated effluent to the average quantity of diluting water available at the point of disposal or at any point under consideration; usually expressed in percentage. Also called available dilution.

Discharge
(1) As applied to a stream or conduit, the rate of flow, or volume of water flowing in the stream or conduit at a given place and within a given period of time. (2) The passing of

water or other liquid through an opening or along a conduit or channel. (3) The rate of flow of water, silt, or other mobile substance which emerges from an opening, pump, or turbine, or passes along a conduit or channel, usually expressed as cubic feet per second, gallons per minute, or million gallons per day.

Disinfectant — A substance used for disinfection.

Disinfected Wastewater — Wastewater to which chlorine or other disinfecting agents has been added, during or after treatment, to destroy pathogenic organisms.

Disinfection — The art of killing the larger portion of microorganisms in or on a substance with the probability that all pathogenic bacteria are killed by the agent used.

Dispersion — (1) Scattering and mixing. (2) The mixing of polluted fluids with a large volume of water in a stream or other body of water.

Disposal by Dilution — A method of disposing of wastewater or treated effluent by discharging it into a stream or body of water.

Dissolved Oxygen — The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million, or percent of saturation. Abbreviated DO.

Dissolved Solids — Theoretically, the anhydrous residues of the dissolved constituents in water. Actually, the term is defined by the method used in determination. In water and wastewater treatment the Standard Methods tests are used.

Drainage Basin — (1) An area from which surface runoff is carried away by a single drainage system. Also called catchment area, watershed, drainage area. (2) The largest natural drainage area subdivision of a continent. The United States has been divided at one time or another, for various administrative purposes, into some 12 to 18 drainage basins.

Drinking-Water Standards — (1) Standards prescribed by the U.S. Public Health Service for the quality of drinking water supplied to interstate carriers. (2) Standards prescribed by state or local jurisdictions for the quality of drinking water supplied from surface-water, groundwater, or bottled-water sources.

Effluent — (1) A liquid which flows out of a containing space. (2) Wastewater or other liquid, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof. (3) An outflowing branch of a main stream or lake.

Embayment — (1) A deep depression in a shoreline forming a large open bay. (2) An area within the swing of a bend of a river.

Enzyme — A catalyst produced by living cells. All enzymes are proteins, but not all proteins are enzymes.

Escherichia Coli (E. Coli)	One of the species of bacteria in the coliform group. Its presence is considered indicative of fresh fecal contamination.
Estuarine	Of, pertaining to, or formed in an estuary.
Evaporation	(1) The process by which water becomes a vapor at a temperature below the boiling point. (2) The quantity of water that is evaporated; the rate is expressed in depth of water, measured as liquid water, removed from a specified surface per unit of time, generally in inches or centimeters per day, month, or year.
Filtered Wastewater	Wastewater that has passed through a mechanical filtering process but not through a trickling filter bed.
Five-Day BOD	That part of oxygen demand associated with biochemical oxidation of carbonaceous, as distinct from nitrogeneous, material. It is determined by allowing biochemical oxidation to proceed, under conditions specified in Standard Methods, for 5-days.
Fluvial Deposit	Sediment deposited by the action of streams. Also called alluvial deposit.
Grab Sample	A single sample of wastewater taken at neither set time nor flow.
Groundwater	Subsurface water occupying the saturation zone, from which wells and springs are fed. In a strict sense the term applies only to water below the water table. Also called phreatic water, pherotic water.
Groundwater Basin	A pervious formation with sides and bottom of relatively impervious material in which groundwater is held or retained. Also called subsurface water basin.
Heavy Metals	Metals that can be precipitated by hydrogen sulfide in acid solution, for example, lead, silver, gold, mercury, bismuth, copper.
Imhoff Tank	A deep, two-storied wastewater tank originally patented by Karl Imhoff. It consists of an upper continuous-flow sedimentation chamber and a lower sludge-digestion chamber. The floor of the upper chamber slopes steeply to trapped slots through which solids may slide into the lower chamber. The lower chamber receives no fresh wastewater directly, but is provided with gas vents and with means for drawing digested sludge from near the bottom.
Leaching	(1) The removal of soluble constituents from soils or other material by percolating water. (2) The removal of salts and alkali from soils by abundant irrigation combined with drainage. (3) The disposal of a liquid through a nonwatertight artificial structure, conduit, or porous material by downward or lateral drainage, or both, into the surrounding permeable soil.

Marsh	A tract of soft, wet land, usually vegetated by reeds, grasses, and occasionally small shrubs.
Milligrams Per Liter	A unit of the concentration of water or wastewater constituent. It is 0.001 g of the constituent in 1,000 ml of water. It has replaced the unit formerly used commonly, parts per million, to which it is approximately equivalent, in reporting the results of water and wastewater analysis.
Monitoring	The measurement, sometimes continuous, of water quality.
Most Probably Number (MPN)	That number of organisms per unit volume that, in accordance with statistical theory, would be more likely than any other number to yield the observed test result or that would yield the observed test result with the greatest frequency. Expressed as density of organisms per 100 ml. Results are computed from the number of positive findings of coliform-group organisms resulting from multiple-portion decimal-dilution plantings.
Navigable Water	Any stream, lake, arm of the sea, or other natural body of water that is actually navigable and that, by itself or by its connections with other waters, is of sufficient capacity to float watercraft for the purposes of commerce, trade, transportation, or even pleasure for a period long enough to be of commercial value; or any waters that have been declared navigable by the Congress of the United States.
Organic Matter	Chemical substances of animal or vegetable origin, or more correctly, a basically carbon structure, comprising compounds consisting of hydrocarbons and their derivatives.
Outfall	(1) The point, location, or structure where wastewater or drainage discharges from a sewer, drain, or other conduit. (2) The conduit leading to the ultimate disposal area. Also see wastewater outfall.
Oxidation	The addition of oxygen to a compound. More generally, any reaction which involves the loss of electrons from an atom.
Oxygen Demand	(1) The quantity of oxygen utilized in the biochemical oxidation of organic matter in a specified time, at a specified temperature, and under specified conditions. See BOD.
Parts Per Million	The number of weight or volume units of a minor constituent present with each one million units of the major constituent of a solution or mixture. Formerly used to express the results of most water and wastewater analyses, but more recently replaced by the ratio milligrams per liter.
Pesticide	Any substance or chemical applied to kill or control pests including weeds, insects, algae, rodents, and other undesirable agents.
pH	The reciprocal of the logarithm of the hydrogen-ion concentration. The concentration is the weight of hydrogen

ions, in grams, per liter of solution. Neutral water, for example, has a pH value of 7 and a hydrogen-ion concentration of 10^{-7}.

Phenol Wastes — Industrial wastes containing phenols, derived chiefly from coking processes and oil refineries.

Plankton — The aggregate of passively floating, drifting, or weakly motile organisms in a body of water. The organisms are mostly microscopic.

Potable Water — Water that does not contain objectional pollution, contamination, minerals, or infective agents and is considered satisfactory for domestic consumption.

Prechlorination — The application of chlorine to water or wastewater prior to any treatment.

Primary Settling Tank — The first settling tank for the removal of settleable soils through which wastewater is passed in a treatment works.

Primary Treatment — (1) The first major (sometimes the only) treatment in a wastewater treatment works, usually sedimentation. (2) The removal of a substantial amount of suspended matter but little or no collodial and dissolved matter.

Process Water — Water that comes in contact with an end product or with materials incorporated in an end product.

Putrefaction — Biological decomposition of organic matter with the production of ill-smelling products associated with anaerobic conditions.

Receiving Body of Water — A natural watercourse, lake, or ocean into which treated or untreated wastewater is discharged.

Recharge — Addition of water to the zone of saturation from precipitation, infiltration from surface streams, and other sources.

Recharge Well — A well constructed to conduct surface water or other surplus water into an aquifer to increase the groundwater supply. Sometimes called diffusion well.

Residual Chlorine — Chlorine remaining in water or wastewater at the end of a specified contact period as combined or free chlorine.

Saline Contamination — Contamination of water by intrusion of salt water.

Salinity — (1) The relative concentration of salts, usually sodium chloride, in a given water. It is usually expressed in terms of the number of parts per million of chlorine (C1). (2) A measure of the concentration of dissolved mineral substances in water.

Salt-Water Intrusion — The invasion of a body of fresh water by a body of salt water. It can occur in either surface or groundwater bodies. The balance between the two under static conditions is expressed in the principle of the U-tube. Also called salt-water encroachment.

Sanitary Sewer

A sewer that carries liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of ground-, storm, and surface waters that are not admitted intentionally.

Secondary Wastewater Treatment

The treatment of wastewater by biological methods after primary treatment by sedimentation.

Sedimentation

(1) The process of subsidence and deposition of suspended matter carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material. Also called settling. See chemical precipitation. (2) In geology, sedimentation consists of five fundamental processes: weathering, erosion, transportation, deposition, and diagnesis or consolidation into rock.

Sewage

The spent water of a community. Term now being replaced in technical usage by preferable term wastewater. See wastewater.

Sewer System

Collectively, all of the property involved in the operation of a sewer utility. It includes land, wastewater lines and appurtenances, pumping stations, treatment works, and general property. Occasionally referred to as a sewerage system.

Slough

(1) A small muddy marchland or tidal waterway, which usually connects other tidal areas. (2) A tideland or bottom land creek. A side channel or inlet, as from a river or a bayou; may be connected at both ends to a parent body of water.

Sludge

(1) The accumulated solids separated from liquids, such as water or wastewater, during processing, or deposits on bottoms of streams or other bodies of water. (2) The precipitate resulting from chemical treatment, coagulation, or sedimentation of water or wastewater.

Sludge Digestion

The process by which organic or volatile matter in sludge is gasified, liquified, mineralized, or converted into more stable organic matter through the activities of either anaerobic or aerobic organisms.

Spray Irrigation

A method for disposing of some organic wastewaters by spraying them on land, usually from pipes equipped with spray nozzles. This has proved to be an effective way to dispose of wastes from the canning, meat-packing, and sulfite-pulp industries where suitable land is available.

Stabilization Pond

A type of oxidation pond in which biological oxidation of organic matter is effected by natural or artificially accelerated transfer of oxygen to the water from air.

Storm Drain

A drain used for conveying rainwater, groundwater, subsurface water, condensate, cooling water, or other similar discharge to a storm sewer or combined sewer.

Storm Runoff

That portion of the total runoff that reaches the point of measurement within a relatively short period of time after the occurrence of precipitation. Also called direct runoff.

Surface Runoff

(1) That portion of the runoff of a drainage basin that has not passed beneath the surface after deposition. (2) The water that reaches a stream by traveling over the soil surface or falls directly into the stream channels, including not only the large permanent streams but also the tiny rills and rivulets. (3) Water that remains after infiltration, interception, and surface storage have been deducted from precipitation.

Suspended Matter

(1) Solids in suspension in water, wastewater, or effluent. (2) Solids in suspension that can be removed readily by standard filtering procedures in a laboratory. See suspended solids.

Suspended Solids

(1) Solids that either float on the surface of, or are in suspension in, water, wastewater, or other liquids, and which are largely removable by laboratory filtering. See suspended matter. (2) The quantity of material removed from wastewater in a laboratory test, as prescribed in "Standard Methods for the Examination of Water and Wastewater" and referred to as nonfilterable residue.

Tidal Prism

(1) The volume of water contained in a tidal basin between the elevations of high and low water. (2) The total amount of water that flows into a tidal basin or estuary and out again with movement of the tide, excluding any fresh-water flow.

Total Solids

The sum of dissolved and undissolved constituents in water or wastewater, usually stated in milligrams per liter.

Trace

A very small quantity of a constituent not quantitatively determined because of its minuteness.

Tributary

A stream or other body of water, surface or underground, that contribute; its water to another and larger stream or body of water.

Trickling Filter

A filter consisting of an artificial bed of coarse material, such as broken stone, clinkers, slate, slats, brush or plastic materials, over which wastewater is distributed or applied in drops, films, or spray from troughs, dippers, moving distributors, or fixed nozzles, and through which it tickles to the underdrains, giving opportunity for the formation of zoogleal slimes which clarify and oxidize the wastewater

Underground Watercourse

A known and defined subterranean channel, created by natural conditions, that contains flowing water.

Wastewater	The spent water of a community. From the standpoint of source, it may be a combination of the liquid and water-carried wastes from residences, commercial buildings, industrial plants, and institutions, together with any groundwater, surface water, and storm water that may be present. In recent years, the word wastewater has taken precedence over the word sewage.
Wastewater Influent	Wastewater as it enters a wastewater treatment plant or pumping station.
Wastewater Reclamation	Processing of wastewater for reuse.

NOTES