Basin-Delta Mothersite

Salton Sea Home Page

[This document summarizes the 1988 status of the Salton Sea, its problems and their potential solutions. Gulf waterway enthusiasts will note with interest that the 1988 cost estimate for this option was only $250,000,000! You missed your big chance! An especially valuable sectioon of the document is Appendix F, a 59-page "summary of the institutional and legal structure and requirements which will apply to the primary Salton Sea management options being considered." Many government agencies have powers and responsibilities with respect to the Sea and this appendix is the best available introduction as to who is responsible for what. Its relevance has been little altered by the recent formation of new entities such as the Salton Sea Authority. S. Hurlbert, SDSU, December 1998]

Problems and Potential Solutions at Salton Sea

Developed for:
The California Resources Agency

Developed by:
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Executive Summary

This report identifies present progress and future opportunities to manage salinity levels and potential flooding at Salton Sea. It also discusses ongoing activity to control pollution at the Sea and in the New and Alamo River drainages.

There is near unanimous agreement between involved agencies and interests that major beneficial uses associated with the Sea mainly, disposition of agricultural drainwater, sport fishing, nature enjoyment, general recreation and residential/retirement activity should be preserved and, if possible, enhanced. Conversely, failure to control the increasing salinity gradient in the Sea (now at about 41,000 ppm), as well as to effectively manage flooding and pollution, will force action by a number of federal, state and local agencies (Table I). The choice is not, therefore, between action and no action-but between action and reaction.

Three general alternatives capable of improved salinity control and flood management have been identified. These alternatives are: construction of an in-Sea impoundment to concentrate salts through evaporation, leaving salinity in the balance of the Sea at lower levels; pumping water out of the Sea, evaporating the water, and using residual salts to generate Solar energy; and constructing a waterway capable of accommodating pleasure craft from the Salton Sea to the Gulf of California, to effect water exchange. The estimated costs of these alternatives range from $100 million to $350 million. Anticipated benefits from control of salinity, flooding and pollution are expected to be much greater, however.

Each alternative has its own interested supporters. Further, necessary scientific data to estimate required salinity targets at the Sea will not be available until mid-1990. This suggests an incremental approach to problem solving at the Sea: developing needed scientific data over the next two year period; developing the three identified alternatives further and establishing a detailed funding strategy for each during the same period; and making a decision on which alternative(s) should be fully implemented subsequent to establishment of salinity targets in 1990. This progression is outlined in Figure 1 (pg. 39). Such an incremental strategy will be essential to effective remedy of the Sea's problems. The remedies proposed are large scale and complex and will only be achieved by continued effort over several years. Such remedies have significant financial requirements, dictating development of a similarly measured and sophisticated funding approach, if implementation is to be successful. Lack of such a coordinated funding approach has likely been a major impediment to resolution of problems at the Sea over the past two decades.

Considerable progress has already been made along these lines during present analysis. The key to this progress has been the association of interested participants with each of the remedial alternatives identified. These groups are referred to as "action teams" in our report, and can play a leading role in progressive management of the problems identified. They are identified in Table II. Financial resources to pursue recommended interim tasks: to set salinity standards; to update the In-Sea Impoundment option; and to conduct a reconnaissance evaluation of the Gulf Waterway option are in hand, or are likely to be obtained shortly. The Pumpout/Evaporation/Solar option is ready for modular testing and development. Its immediate funding needs are consequently more substantial. Some funding and in kind support has already been committed to this option, and interested parties are working with the Facilitator to develop further funding. The present status of recommended programs is described in Table III.

In sum, we have concluded that remedy at Salton Sea is desired by virtually all parties, would be beneficial and is possible. We have identified a progressive strategy to that end. Actual movement by interested agencies toward the potential remedies indicated in our report can already be observed.

Table I
A Summary of Principal Agency Authorities and Responsibilities, Should Adverse Trends at Salton Sea Continue

Adverse Trends	Triggering Event	Principal Responsible Agencies
1. Salinity continues to increase	l a. Exceeds specified standard(s)	- RWQCB -SWRCB -EPA -USBR
	l Adversely affects	-CF&G

	b. fish and wildlife	-FWS -RWQCB -SWRCB
2. Pollution at unsatisfactory levels	2 a. Exceeds health standards	-CA. Dept. of Health Services -RWQCB -SWRCB -EPA -Gov't of Mexico -Int'l Boundary & Water Comm. -USBR
	2 b. Adversely affects fish or wildlife	-CF&G -FWS
3. Water levels at the Sea increase	3 a. Flooding	-SWRCB -IID -CVWD -Imperial County -Riverside County. -CA Parks & Recreation -USBRA

The scope of USBR involvement cannot be definitively stated at this stage.

Table II
Potential Participants--Remedial Action over the 1988-1990 Period

Action Team	Task (s)	Potential Participants
1. Salinity Standards & Water Quality	l a. Complete salinity studies for sport fish.	CF&G SWRCB RWQCB EPA FWS
2. In-Sea Impoundment	2 a. Update cost analysis. 2 b. Consider seismic risk issue	CVWD
3. Pumpout/Evaporation/Solar	3 a. Test module.	IID Imp. County ORMAT CA Energy Comm. USBR CF&G FWS DWR(?)
4. Gulf Waterway	4 a. Conduct reconnaissance analysis.	Corps USBR CF&G FWS CA. Boating &Waterways

Preliminary, subject to revision.

Table III
Present Status of Action Teams-Remedial Action at Salton Sea

Action Team	Agency	Status of 1988-90 Tasks
1. Salinity Standards & Water Quality	l a. CF&G	l a. Has resources to complete by mid-1990.
	l b. RWQCB SWRCB EPA FWS	l b. Continued monitoring, testing & development of water quality standards.
		l b. Interface with action teams re. requirements & funding of alternatives.
2. In-Sea Impoundment	2. CVWD	2. Will complete by mid1990
3. Pumpout/Evaporation/ Solar	3 a. IID ORMAT	3 a. Have committed Imp. Cnty. $100,000.
	3 b. USBR	3 b. Has committed to conduct feasibility analysis of Yuma saline return line.
	3 c. CF&G FWS	3 c. Have committed to "in-kind" participation in module design &testing.
	3 d. All team entities (see Table II)	3 d. Have agreed to explore avenues for funding support
	3 e. All team entities	3 e. Have agreed to scope module project &assign sub-tasks.
4. Gulf Waterway	4 a. Corps	4 a. Will likely agree to conduct physical structure reconnaissance study.
	4 b. USBR	4 b. Has agreed to conduct reconnaissance evaluation of potential environmental impacts.
	4 c. CF&G FWS CA. Boating & Waterways	4 c. Have agreed to participate in above reconnaissance analysis.

1. A Brief Background

The Salton Sea is a terminal lake, created by accidental flooding from the Colorado River at the turn of the century. Since 1920, the Sea has served as a depository for agricultural irrigation drainage. The Sea also receives storm runoff and scant amounts of rainfall. The drainage water, and in fact, Colorado River water used for irrigation, contains dissolved salts, and this factor, together with evaporation in the area's desert environment has created a saline sea, which, for the past several decades, has approximated ocean salinities [ocean salinity is about 35,000 parts per million (ppm)]. As a result, sport fish were introduced from the ocean, state and federal wildlife refuges were established at the Sea, and activity infrastructure focusing on recreators (primarily boating and fishing) and retirement residences began to expand and prosper.

In recent years, serious concern has been evident over the Sea's future. The trend toward increasing salinity of Sea waters was temporarily abated in the late 1970's and early 1980's, but this was achieved by relatively high levels of water inflow into the Sea from rivers and drains (the Sea's only source of "fresh" water), which caused flooding. Salinity in the Sea now exceeds 40,00 ppm, and while there is not yet substantive measurable evidence of fishery decline, damage to the Sea's fish populations, attendant loss of significant portions of dependent wildlife and increased unpleasant odors from the Sea itself can be predicted with certainty if salinity increases continue. Concern over pollution, both organic and inorganic, has also been evident in recent years.

The Sea continues as a viable depository of agricultural drainage from the Imperial and Coachella Valleys

today. However, recreational use of the Sea has declined markedly, largely, it appears, as a result of recent posted warnings against human contact with the Sea in some areas and respecting consumption of fish. The envisioned broader recreation residential potential of the Sea is also clearly not being realized. (See Section 4).

Finally, the conditions and trends outlined here are expected to continue if left to take their own course. Such evolution threatens the approximate 100,000 residents of Imperial County, and those residents of Riverside County living in the Coachella Valley, especially persons who value the Sea for resident/recreational purposes, and/or who gain economic benefit from the recreational infrastructure dependent on it. This may be particularly important in Imperial County, where per capita income is lower than the state average, and unemployment often reaches significant levels. Important recreational opportunity for residents of California's populous south coastal area will also be preempted, and national and state wildlife resources will be lost. The Torres-Martinez Indian Reservation is found along the Sea's northwest shore, and would be negatively impacted by these trends.

While threats posed by conditions at Salton Sea are significant, solutions are neither easy nor inexpensive, and are clearly beyond the capabilities of local entities along.

2. Present Significant Problems

i) Flooding

Flooding may not be the most serious problem at Salton Sea, but it is among the most immediate. In 1949, the Sea's elevation stood at 240 feet below Sea Level. Levels gradually increased in subsequent years--and reached a high of 226.6 feet below sea level in 1983, assisted in that year by extensive storm-related runoff. Basic data of Sea levels and water balances are included in Appendix A.

This approximate 13 1/2 foot increase in level of the Sea has flooded several areas near the Sea, and fairly extensive litigation has ensued. The objective of Imperial County, and others, is to prevent future shoreline development below elevation--220 feet. this is about 7 feet above the flood highs of 1983, and should pose an absolute upper level constraint for future planning affecting the Sea. A "desirable" construct might see establishment of a lower absolute Sea level, perhaps approximating 230 feet below sea level--so that some of the flooded shore lands might be reclaimed. This would have the sea declining at least 3 1/2 feet from 1984 levels, to achieve elevations in effect in about 1875.

Parsons (1985) provides historic data on flows of water into Salton Sea through 1984 (Appendix B). In the 1981-84 period, the Sea received an average of 1.3 million acre feet of "fresh" water annually. Of this total 79, percent comes from irrigation drainage, 16 percent from Mexico via the New and Alamo Rivers, and the balance from "other" sources. Of these sources, inflows from IID and CVWD appear to have been decreasing, while flows from Mexico have been increasing.

In sum, potential flooding at Salton Sea likely serves as a constraint on remedial planning. For a variety of reasons, flows from Mexico have been the least predictable contributors to Salton Sea inflow in the past.

ii) Salinity

While flooding provides a constraint to remedial management at Salton Sea, the focal issue at the Sea for more than a decade has involved salinity, which has increased fairly steadily since 1955 until it now exceeds 40,000 ppm (Appendix C). This may be approaching the upper range of tolerance for sport fish species that inhabit the Sea. Increased salinity is occurring because the Sea is a closed sink and evaporation in the Sea concentrates the salts found in Colorado River water supplies. (Again see Appendix A). In sum, any attempt to stabilize salinity levels in the Sea must consider both volume and salinity of inflow to the Sea; surface area of the Sea and related evaporation; and any removal of saline water from the Sea.

iii) Pollution

Significant localized pollution problems exist at or near Salton Sea. The New River, which flows into the United States from Mexicali, and hence runs northward through farm land to the Salton Sea has been a focal point of concern. At the border, the New River flows at about 350 cfs, an increase from about 50 cfs in 1950. This increased flow has resulted from expanded agricultural activity in Mexico, and from growth of Mexicali, now an urban industrial area of over 1 million people. The waters of the New River are grossly polluted where they cross the international boundary. About half of Mexicali is without a sewer system, and considerable human, livestock and industrial waste finds its way untreated into the River. Specifics are provided in a 1987 report by Montgomery Engineers for California Regional Water Quality Control Board. On the immediate United States side of the boarder, the waters of the New River are posted as dangerous to humans, and also provide an attractive breeding ground for mosquitoes that carry encephalitis.

As the New River flows northward toward Salton Sea it is joined by agricultural drain water, substantially increasing flows at the River mouth, and diluting pollutants from the upper river. Nonetheless, health warnings are present at the river mouth, as are strong adverse odors. The necessity of dealing with a foreign country complicates effective management of this ongoing problem.

Selenium has also been detected in concentrations that sometimes exceed EPA advisory levels, in portions of the Salton Sea. A review of these standards is presently underway. Concentrations do not appear sufficient to result in large scale preemption of agricultural activity in the Imperial Valley, although basic data is still being collected.

Action to address both the New River and selenium pollution problems affecting Salton Sea will be required. That action will most probably focus on treatment of New River flows just north of the international boundary, and on some adjustment in practices associated with management of agricultural drain water. Momentum toward best management practices in agriculture, and to control Colorado River selenium impacts will also 1ikely contribute positively to overall management of the selenium issue.

Management of pollution problems is not interconnected directly to salinity and flooding issues. Our approach here will be to first focus on salinity and flooding issues, and then consider pollution management in a following section.

3. Values at Stake at Salton Sea

a) General Economic Activity -- and the Role of Agriculture

Agriculture is the largest contributor to the economic well-being of Imperial County, producing average annual gross crop revenue of $733 million during the 1984-86 period and over 11,000 jobs (County of Imperial, 1987). Government is the second largest employer in the county, providing about 8,000 jobs annually. An overall profile of wage and salary employment is provided in Table 1.

Table 1
Employment Profile for Imperial County

Industry	Number of Jobs (1986)	Percent of Total
Agriculture	11,200	32
Government	8,025	23
Wholesale/Retail	7,975	23
& Commerce Services	4,025	12
Mining, Construction	2,875	8
& Transportation	1,325	4
Manufacturing	34,800	
All Industries		

*Numbers do not add to 100 due to rounding.
Source: County of Imperial (1987).

Per capita income in Imperial County is lower, while unemployment is higher than for the state as a whole (Table 2).

Table 2
Per Capita Income and Rate of Unemployment-
Imperial County and the State of California

	Imperial County	California
Per Capita Income (1984)	$9,980	$14,374
Rate of Unemployment (1986)	23.9%	6.6%

Sources : County of Imperial (1987)
: Department of Finance (1987)
: County Supervisors Association of California (1987)

Only an eastern portion of Riverside County abutts the Sea, in the Coachella Valley area. According to the Coachella Valley Water District (CVWD), crops serviced by CVWD are also of major significance, generating some $286 million in farm revenue in 1985. Riverside County varies considerably, from its urbanized western extremities to more rural eastern districts. Consequently, the overall county per capita income figure of $13,030 (1984) and unemployment rate of 7.8 percent may overstate economic well-being in Coachella Valley. Even then, Riverside County's overall employment rate was only 37th out 59 counties in 1986.

b) Land Values at the Sea

Land values are another important parameter particularly affected by Salton Sea. Development Research Associates (1969) reported lot values between $2,000 and $4,000 around Salton Sea. In 1972, USBR did a land sales analysis at the Sea, finding an average value of $4,300 per improved lot. They further concluded the land values around Salton Sea were heavily dependent upon an attractive Sea environment.

"...99 percent (plus) of the vacant land value is attributable to the Salton Sea". (pg. 24)

Finally, USBR noted that no significant trend toward increased 1 and value around the Sea was then evident. We also We also checked present lot values at the Sea with appraisers in Imperial and Riverside counties. Information obtained from these sources and from earlier cited studies are displayed in Table 3.

Table 3
Data on Serviced Residential Lot Prices-
-Salton Sea and Surrounding Areas

Area	1969	1972	Land Value At present
	----------$----------		
	2,000-4,000	4,300	
On Salton Sea			2,500-4,000
Salton City			6,000-6,500
Desert Shores			1,000-1,500

Date Palm Beach	2,500
North Shore Beach Estates	3,000-5,000
Mecca	8,500-10,000
Coachella	12,000-18,000
Indio	
Bermuda Dunes	10,000-12,000
-Non-Country Club	30,000
-Country Club off Fairway	
-Fairway Homes	50,000

Data from Coachella, Indio and Bermuda Dunes are included to illustrate the step-up as one leaves the Sea, moves progressively through Coachella and Indio, and then enters the higher value residential/retirement communities expanding eastward from Palm Springs. Table 3 suggests that lot values adjacent to the Sea have changed little over the past 20 years.

c) Recreation at Salton Sea

Recreation has been an important traditional focus at Salton Sea. Referencing preliminary data for CIC Research (1988) for the California Department of Fish and Game, the following usership may be inferred for the Sea (Table 4).

Table 4
Estimated Southern California Households Visiting Salton Sea

	Households Visiting in Past 12 Months		Households Visiting, but Not in Past 12 Months	
County	Percent %	Households (1986) '000	Percent %	Households (1986)
Imperial	14.9	4.9	16.8	5.5
Riverside	2.7	8.3	20.7	63.6
Los Angeles	2.9	86.6	10.8	322.5
Orange	2.1	16.5	9.6	75.4
San Bernardino	4.8	18.4	22.8	87.4
San Diego	4.0	31.2	14.8	115.4
Ventura	2.3	5.2	7.0	15.8
Santa Barbara	2.0	2.5	6.6	8.2
San Luis Obispo	1.5	1.1	7.0	5.1
Total	3.9	174.7	13.1	698.9

The CIC study reported fishing as the most important motive for visiting the Sea, followed by camping, picnicking and boating. Applying preliminary data from an intercept survey in the same report, it may be inferred that the participation levels identified in Table 4 support a total of 1.6 million recreation days annually at Salton Sea. Using a further CIC (1988) preliminary expenditure estimate of $218.58 per trip, annual recreational expenditures of $103.1 million can be associated with Salton Sea recreation. Finally, respondents to the CIC survey indicated that they considered Salton Sea a major recreational area, that improvements to wildlife and fishing at the Sea were required, and that they would be willing to pay a small fee to achieve these objectives.

In 1969, Development Research Associates (DRA) completed a comprehensive analysis of benefits associated with Salton Sea. This study is of interest for two reasons. First, it provides a relative measure of recreational use, compared to the more recent CIC preliminary estimate. Second, it developed a careful estimate of economic benefits to the Salton Sea area with and without effective management of salinity at the Sea.

User estimates for 1967 by DRA amounted to approximately 1.5 million annual recreation days. This is very close to the estimate of million days inferred from 1987-88 CIC data and suggests that as with land values, recreational use in the Salton Sea area seem little changed over the past two decades.

d) Potential Economic Impact With and Without Control of Salinity and Associated Problems at Salton Sea

Since the early studies by Development Research Associates (DRA) (1969) and USBR (1972), considerable effort and discussion has occurred, but no effective remedial focus has yet been established and implemented with respect to problems of salinity, flooding and pollution at Salton Sea. As a result, recreational participation, land values and general levels of economic activity around the Sea have not changed much over the past two decades, and have not kept pace with trends in adjacent Southwestern California. In this sense, failure to deal effectively with the Sea's problems can be equated with loss of significant potential economic and social benefits.

The DRA study seems particularly useful for measuring benefits foregone, for the recreational participation rates and land values that they considered in 1969 still approximately hold around the Sea today, while risks to fish and wildlife resources have increased. Combining estimates from the DRA study, updated to present dollars, with preliminary results from CIC (1988), we can develop policy level estimates of benefits at stake at Salton Sea. These estimates do not provide a detailed forecast of future economic options. Such a forecast would require far more detailed data and analysis than is provided here. Data is considered sufficient, however, to develop "order of magnitude" estimates of potential gains or losses associated with management of the Sea. Results are presented in Table 5. Procedures are as follows.

i) For the "no solution alternative", assume general recreation remains at present levels, then drops to half after the year 2000, when fish and fifty percent of wildlife are assumed to disappear. This is more optimistic than the scenario used by DRA;

ii) Relate preliminary recreational direct expenditure data from CIC to the adjusted trend lines;

iii) Update DRA estimates of residential construction values at Salton Sea, to present dollars;

iv) Update DRA's estimates of increase in recreation-oriented commercial construction activity, to present dollars;

v) Assume construction values for new residences and for recreation-related commercial establishments increase by 2.25% annually if fish and half of wildlife are lost. This may be an optimistic projection.

Table 5
Potential Economic Values Associated with Effective Management at Salton Sea

Year	Recreational Expenditures		Value of Housing Construction		Recreation-Related Commercial Construction	
	Solution	No Solution	Solution	No Solution	Solution	No Solution
1987	103.1	103.1	129.2	129.2	3.0	3.0

2000	165.6	103.1	252.0	172.5	6.7	4.0
2010	347.3	51.6	573.3	215.5	21.1	56.2.0
2020	372.1	51.6	919.8	269.2	25.6	

Again, these estimates are conjectural and are presented for comparative policy purposes. They are, however, generally reflective of prior economic analysis and ongoing conditions at Salton Sea. They suggest that effective management of salinity, flooding and pollution problems at Salton Sea could generate over $200 million in additional annual recreation expenditures, and at least $670 million in additional construction activity. These estimates could very well be conservative, particularly as they fail to incorporate likely increases in land value associated with the enhancement process.

In conclusion, the importance of the Sea's role for agriculture must be reemphasized. Our discussion of economic stakes at Salton Sea has focused on value foregone by residential and recreational complexes, should the Sea's problems remain unresolved. Agricultural productivity has been, and remains today the most important economic activity dependent on Salton Sea (recall Section 3a). Consequently, actions to capture the substantial benefits illustrated in Table 5 must be consistent with protection of the traditional agricultural benefits that have sustained the region.

4. Goals and Objectives of Present Agencies/Interests at Salton Sea

Based on foregoing discussion of economic stakes and ongoing problems at Salton Sea, the goals and objectives of existing affected entities are fairly predictable. Tables 6 and 7 summarize these objectives, based on a formalized survey taken during our ongoing study period. Not all agencies answered the survey in the same way, and some interests have not yet responded. The results presented here are consequently "as received by this date". Further, EPA provided narrative response. This is enclosed in Appendix D. Table 6 summarizes returns from agencies indicating "direct involvement's in each indicated use only. Table 7 supplies a broader indication of relative support, regardless of whether a direct linkage exists or not.

Table 6
Priorities Respecting Future Use of Salton Sea - - For Agencies/Interests Having Direct Involvement

Uses	CVWD	Imperial County	IID	CF&G	EC	FWS	Ass. BradIey's Office
Receive Ag. Drainwater	R	S	R	--	--	--	R
ReceiveTreated Waste	R	SS	--	--	--	--	--
Boating	--	R	--	--	--	R	--
Fishing	--	R	--	S	--	R	--
Parks	--	R	--	S	--	R	--
Mining	--	R	--	--	--	--	--
Geothermal Development	--	R	--	--	--	--	--
Solar Energy	--	S	R	--	SS	--	--
Shoreline Residential	--	S	--	--	--	--	--
Storm Runoff	--	R	--	--	--	--	--
Untreated Waste	--	N	N	N	--	--	--

Legend: R = Required use
S = Used supported
SS = Use somewhat supported

N = Use should not be permitted

Table 7
Priorities Respecting Future Use of Salton Sea -- All Agencies and Interests

Uses	CVWD	Imperial County	IID	CF&G	EC	USBR	FWS	Ass. Bradley's Office	Salton Sea Coord. Council
Receive Ag. Drainwater	R	S	R	S	--	S	S	R	S
ReceiveTreated Waste	R	SS	S	SS	--	S	--	SS	SS
Boating	S	R	S	SS	--	--	R	S	S
Swimming	S	SS	S	S	--	--	--	S	S
Fishing	S	R	S	S	--	--	R	S	S
Parks	S	R	S	S	--	--	R	S	S
Mining	S	R	SS	SS	--	--	--	N	N
Geothermal Development	--	R	--	--	--	--	--	--	--
Solar Energy	S	S	R	S	SS	S	--	S	S
Shoreline Residential	S	S	SS	S	--	--	SS	S	S
Storm Runoff	--	R	--	--	--	--	--	--	--
Gulf Waterway	--	SS	SS	SS	--	--	SS	S	S
Untreated Waste	N	N	N	N	--	N	N	N	N

Legend: R = Required use
S = Used supported
SS = Use somewhat supported
N = Use should not be permitted

Legend: See Table 6

Tables 6 and 7 indicate that failure to resolve problems at Salton Sea cannot be related to lack of common objectives. While each agency or interest sees its own particular objectives as unique, there is a broad tolerance of the interests of others. Table 8 considers future action priorities at the Sea, for those agencies/interests who consider themselves directly affected. Table 9 provides the same priority information for all agencies/interests, whether affected or not.

Table 8
Action Priorities at Salton Sea -- Directly Affected Agencies/Interests

Action	CVWD	Imperial County	IID	CF&G	FWS	EPA
Control	--	B	--	R	R	R

Salinity to Protect F i s h						
Lower Sea Level	R	--	R	B	B	--
Stabilize Sea Level	R	R	R	B	R	--
EstablishMinimum Elevation Around Sea for Development	--	R	R	--	--	--
Treat New River Pollution	--	R	--	--	R	R
Treat Alamo River Pollution	--	R	?	B	R	R
Control Selenium	?	R	--	--	--	--
Turn Sea into Waste Depository	N	N	--	N	N	--
Raise SeaLevel	N	--	N	--	--	--

Legend: R = Action is required
B = Action would be beneficial
N = Action would not be beneficial
? = More research is needed to define problem (if any)

Table 9
Action Priorities at Salton Sea -- All Agencies

Action	CVWD	Imperial County	IID	CF&G	Calif. Health Serv.	USBR	FWS	Ass. BradIey's Office	Salton Sea Coord. Council	Salton Sea Coord. Council
Control Salinity to Protect Fish	B	B	B	R	B	B	R	R	B	B
Lower Sea Level	R	--	R	B	--	B	B	--	N	B
Stabilize Seal Level	R	R	R	B	--	B	R	--	B	B
Establish Minimum Elevation Around	B	R	R	--	--	B	--	--	B	N

Sea for Develop.										
Treat New River Pollution	B	R	B	B	B	--	R	R	B	B
Treat Alamo River Pollution	--	R	--	--	--	--	--	--	--	--
Control Selenium	?	R	?	B	B	B	R	R	B	B
Turn Sea into Waste Depository	N	N	--	N	N	--	N	--	N	N
Raise Sea Level	N	--	N	N	--	N	--	--	N	N

Legend: See Table 8

Again, there is considerable agreement over actions to be taken at Salton Sea. It is our consequent conclusion that impediments to effective action do not lie in the area of consensus on "requirements or "needs".

5. Authorities and Responsibilities - Existing Conditions

Failure to resolve problems at Salton Sea will likely trigger required actions by a number of federal, state and local agencies. The nature of these legal responsibilities, together with associated response to the major remedial alternatives identified in this report, are generally discussed in Appendix F. In Table 10, we identify the major issues, triggering events and agencies where action will likely be required as a result of such events. It should be emphasized that this tabular presentation is in summary form. Readers should consult Appendix E for a more extensive discussion of potential agency authorities and responsibilities. In fact, it will be recognized that, given the time and resources available to our project, Appendix E is itself somewhat summary in nature.

Finally, we do not represent that Table 10 identifies all legally responsible agencies. Rather, we have attempted to identify obvious responsibilities, taking the perspective that these agencies may very well have lead involvement, should the adverse events identified in the table occur.

Table 10
A Summary of Principal Agency Authorities and Responsibilities, Should Adverse Trends at Salton Sea Continue

Adverse Trends		Triggering Event	Principal Responsible Agencies
1.	Salinity continues to increase	l a.	Exceeds specified standard(s	-RWQCB -SWRCB -EPA -USBR*
2.	Pollution at unsatisfactory	1 b.	Adversely affects fish and wildlife	-CF&G -FWS

	l evels			-RWQCB -SWRCB
		2 a.	Exceeds health standards	-CA. Dept. of Health Services -RWQCB -SWRCB -EPA -Gov't of Mexico -Int'l Boundary & Water Comm. -USBR
		2 b.	Adversely affects fish or wildlife	-CF&G -FWS
3.	Water levels at the Sea increase	3 a.	Flooding	-SWRCB -IID -CVWD -Imp. County -Riverside Cty. -CA Parks & Rec. -USBR

*The scope of USBR involvement cannot be definitively stated at this stage.

From Table 10, we conclude that the State Water Resource Control Board (SWRCB) and the Regional Water Quality Control Board (RWQCB) have significant responsibilities in all issue areas, both with respect to maintenance of appropriate quality standards and protection of beneficial uses. The Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS) and the California Department of Fish and Game (CF&G) also have significant lead responsibilities. It would appear that local responsibilities are most prevalent with respect to the flooding issue. in the time available, our legal experts were not a b 1 e to reach a firm option concerning the responsibilities of the U.S. Bureau of Reclamation (USBR). While USBR has significant involvement in events at Salton Sea, we have consequently left this as a question.

It is our conclusion, based on Table 10, that "taking no action" is not a choice at Salton Sea. If adverse trends continue, agencies with legal authority and responsibility will eventually be forced to act. The management choice, then, is rather one of action versus reaction with respect to adverse events at Salton Sea.

6. Likely Physical Trends Affecting the Future of Salton Sea

i) Decreased Drainage Inflow to Salton Sea

Consumable water is becoming an increasingly valuable and sought after resource in California. In this context, the State Water Resources Control Board recently directed IID to introduce practices that would conserve greater amounts water in the Imperial Valley. That order is presently being litigated. At the same time, however, IID has developed a water conservation plan and is introducing conservation measures into its water system. IID (1986) estimates that an actual annual savings of 358,000 acre feet might be achieved by such measures- implying a reduction in annual drainage inflow to the Sea of slightly less than this amount. Reductions in inflow of about 15,000 acre feet annually of relatively high quality reclaimed water from wastewater treatment plants are expected during the next decade (Levy, 1986). As the Central Arizona Project goes into full operation, cutbacks in inflows from Mexico via the New River are also expected. Taking these factors together, significant cutbacks of inflow into the Salton Sea are expected over the next decade, perhaps eventually reducing annual inflows to 1 million acre feet of less. This can, in turn, be expected to reduce Sea level.

ii) Increasing Salinity at Salton Sea

It was earlier observed that salinity has increased at Salton Sea since 1955. The conservation measures cited above can be expected to accelerate this trend. Consequently, it is reasonable to assume that without remedial action, marine life in the Salton Sea will eventually die off, and that recreational/retirement activity based on fishing will decline, or at least fall behind other Southern California areas.

iii) Pollution

As Mexicali grows in size, and water flows from Mexico decline, pollution concentrations in the New River will increase. As we have noted, efforts are currently underway to address this issue on both sides of the border. We expect progress to be made but are not optimistic, under existing conditions, that a complete solution is yet in. sight.

iv) Recreation/Retirement Complexes in the Northwest Quadrant of the e-a

High value desert retirement /recreation communities have spread eastward from Palm Springs until they are now only a few miles from the northwesterly boarder of the Sea. This advance to the east and south is expected to continue, and will introduce a new element to the Sea's future over the next decade. The essential question will be whether these developments capitalize on the Sea as a major recreational amenity, or avoid it due to fish and bird die-offs, and any other noxious effects.

v) Increasing Importance of Solar Energy

At present, large scale production of solar energy from salt ponds does not appear commercially feasible in the United States. Energy experts predict, however, that it will become increasingly so over the next 1 to 2 decades. Small piloting facilities have recently come online in the U.S., and Israel is pioneering solar salt pond development at the Dead Sea. Salton Sea has obvious potential in that regard.

7. Remedial Alternatives at Salton Sea

In the course of this and previous analyses, a number of alternative actions that would move toward eventual stabilization of Salton Sea have been identified. These options are briefly described in this section. First , three actions, and two potentially complementary actions to stabilize salinity and flooding at the Sea are identified. Then the general characteristics of a program to control pollution are discussed.

A. Options to Stabilize Salinity and Sea Level

1. Pumpout / Desalination / Solar Generation

One alternative proposed for Salton Sea has involved pumpout of Sea water onto land, where it is evaporated, leaving saline residue. In a subsequent step, this residue could be utilized in a solar plant to generate electricity. Holdsworth (1987) estimates that slightly more than 100,000 acre feet per year would have to be pumped from the Sea under present conditions to stabilize both Sea salinity and Sea level, assuming a salinity target of 40,000 ppm. This would be achieved over about 70 years. At a salinity target of 45,000 ppm, stability could be achieved far more quickly, and likely with less pumping. The vertical evaporation process proposed by ORMAT to achieve this option brings the process within marginal land availabilities in the Salton Sea area. Construction costs for the full system would be expected to run in the order of perhaps $6 million for and, $72 million for the evaporation process and $25 million for generation of 25 MWT of solar energy or a total of about $100 million+. Feasibility work is presently being funded by IID, Imperial County and ORMAT ($100,000). A $10-12 million proposal for module testing has been submitted to state government.

2. A Saltwater Impoundment in Salton Sea

A 50 square mile diked impoundment in Salton Sea was the recommended solution of the 1974 Task Force. The dike would be a partially submerged continuous 37-mile long earth "dam" built on the Sea floor, with its shoreward side generally 112 to 1 mile from shore. The impoundment would encompass about 14 percent of the Sea's surface area and would last for about 100 years before it "filled up" with salt. It was estimated to achieve a salinity in the Sea of 35,000 ppm in 12 years. Updating estimated 1974 costs to 1986, this option would cost between $125 million and $155 million, with annual operating costs of about $1 million.

A smaller 40 square mile impoundment was estimated to return Sea salinity to 35,000 ppm within 18 years. It was estimated to cost, at most about $140 million, plus annual operating costs of about $600,000 (in 1986 dollars). These alternatives are still judged technically feasible today. Recent concern has been expressed regarding possible "leakage" from the impoundment into the Sea, and possible vulnerability to earthquake. These issues may -require further consideration.

This alternative has been extensively scoped in earlier technical analysis (see the 1974 Task Force Report). A decision needs to made whether to go forward with this and/or other options in 1990 (see subsequent schedule).

3. Gulf Waterway Option

In 1971, the Aerospace Corporation identified a plan to stabilize Salton Sea salinity and water level via a pumping capability to the Gulf of California. That proposal holds little benefit for Mexico, and is consequently not deemed feasible. A waterway with appropriate locks, to enable pleasure craft to travel back and forth between the Salton Sea and the ocean is, however, being considered as one present option. This solution would enable control of salinity And water level at Salton Sea, and unlike the canal/pipeline proposal would offer major potential infrastructural benefits to Mexico. It would also complement the expanding retirement/recreation complex in eastern Riverside County, and would provide the basis for a broad new tourism initiative based in Imperial County. This option is estimated to involve a construction cost of $250-$250 million. [The second figure should be $350 million - see Table 14 J.Dainer]. If it reaches the feasibility level, formal discussions and an eventual agreement-with Mexico would be required.

B. Supplementary Options

1. Colorado River Surges

It has been suggested that now that reservoirs on the Colorado River are full, surges of water will be released down the river in wet years, and could be made available to Salton Sea either through existing canals or via an expanded canal system. It will only be appropriate to consider this option after salinity targets are established and after a basic decision regarding the full option response has been reached (post-1990). Prior lowering of the Salton Sea's surface level would seem a prerequisite to avoid flooding. This option would entail periodic fluctuations in water level at Salton Sea, particularly in years when surges were delivered. It would likely require some form of entitlement agreement, either via the Colorado River Board, or in other form. Finally, the record of the past three decades indicates that dilution with Colorado River water cannot, by itself stabilize salinity levels at Salton Sea and keep Sea levels below flood stage. Consequently, any dilution alternative must be combined with enhanced evaporation and/or pumpout.

2. Pump-back of Brine Water to Yuma

If it is considered desirable to operate the evaporation process at a level beyond where the solar plant can utilize all brine produced, it may be necessary to dispose of excess brine. One possibility to do this could be construction of a pipeline back to Yuma and disposal of the brine in a Gulf of California drain established for such purpose as part of the Yuma desalination plant.

C. Dealing with Pollution at Salton Sea

Potential pollutants at Salton Sea cover a broad range of organic and inorganic agents. As noted, however, recent discussion and analysis has concentrated on cleanup of organic and inorganic pollutants from New River and Alamo River, and effective control of selenium. This provides the focus for our present report.

1. Cleanup of the New River

Cleanup of the New River is complicated by the fact that a significant portion of pollutant loading from the river comes from the Republic of Mexico (see previous). The United States and Mexico signed a 1983 U.S. - Mexico Border Environment Agreement, with EPA as the lead agency on this side of the border. Montgomery Consulting Engineers (1987) identified a number of structural alternatives for pollution abatement on the U.S. side of the border, for the California Regional Water Quality Control Board (RWQCB). The State Water Resource Control Board (SWRCB) is presently seeking funds to design a separating screen for gross solids and trash in the river, as well as to conduct other studies. A $1.2 million joint U.S./Mexico project directed at improved collection of waste in Mexicali has just come on line and this is a significant step toward improving the New River situation . Finally, RWQCB continues to monitor New River pollution, and Mexico is cooperating to enable measurement on their side of the border as well. Past improvement at New River has been slow, requiring collection of basic data and cooperative efforts by two nations. Steady improvement is expected to continue, the pace of that action depending on priorities and fiscal capabilities in both countries. In the United States, action is likely to focus on further monitoring, and on consideration of actual pollution abatement alternatives. These will, in turn, depend on decisions reached by SWRCB and EPA over the next several years.

2. Cleanup of the Alamo River

Pollution in the Alamo River is almost entirely generated in the United States. The RWQCB has commissioned a pesticide residue study for the drainage area and continues to pursue selenium issues (see below). Aside from these actions, there appears to be little momentum at either SWRCB or EPA levels. It would consequently appear that pollution issues in the Alamo River will be primarily addressed within the context of management of agricultural drainage.

3. Management of Selenium at Salton Sea

The RWQCB, in concert with the U.S. Geological Survey (USGS) has embarked on a study of selenium sources affecting the Salton Sea area. This study is focusing on tile drainage, soils and Colorado River water. IID is an active cooperator in this analysis.

EPA has recently published Ambient Water Quality Criteria for Selenium (1987) and has requested that the RWQCB incorporate a numerical water quality objective for selenium in its updated Water Quality Control Plan. At present, RWQCB believes that establishing "best practical farm management procedures" with respect to control of selenium will be more effective than a numerical standard. It is anticipated that discussive efforts to resolve this question will continue, with a decision in the first half of 1989. At this point in time, it seems likely that efforts to manage selenium effectively will continue with some sort of combed procedure targeting improved farm practice and eventual standard setting a possible outcome.

8. Programs Affecting Salton Sea

While problems at Salton Sea continue to the present, it is incorrect to conclude that no remedial efforts are underway. In fact, considerable effort is presently ongoing at the Sea. Table 11 summarizes ongoing programs, characterized by type and by agency. Readers should refer to the specific identified agencies for details of the programs identified here. Examinatin of the tdable suggests that to date, progressive efforts at the Sea have focussed on information gathering, with less attention directed to testing and devleopment of actual remedy.

Table 11

Summary of Ongoing Programs at Salton Sea

Type of Program	Program Description	Agency
1. Sea level monitoring	l a. Monthly monitoring program	l a. DWR
2. Flood control	2 a. Analysis of remedial flood control measures in the New River and Alamo River drainages	2 a. Corps.
3. Pollution information gathering and monitoring	3 a. Periodic monitoring of Salton Sea, New River and Alamo River water quality	3 a. DWR RWQCB
	3 b. Bioaccumulation of selenium in aquatic birds and diving ducks	3 b. FWS
	3 c. Drainage area pesticide residue study	3c. RWQCB USGS
	3 d. Selenium sources study re. Salton Sea	3d. USGS RWQCB
4. Pollution control	4 a. Structural alternatives for pollution abatement in New River (completed, 1987)	4 a. RWQCB
	4 b. Improvements to the Mexicali sewage system (just on line)	4 b. Mexico/US
	4 c. Update of Region 7 Water Quality Control Plan (1989)	RWQCB EPA
5. Wildlife studies	5 a. Wildlife habitat and food studies	5 a. FWS
6. Fishery studies	6 a. Salinity tolerance of Salton Sea Sport Fishes	6 a. CF&G
	6 b. Economic importance of the Salton Sea Sport Fishery	6 b. CF&G
7. Evaporation Ponds	7 a. Evaporation pond testproposal	7 a. IID
8. Pumpout/Evaporation/Solar generator	8 a. Feasibility analysis	8 a. IID Imp. County

9. Options for Improvement of the Salton Sea

Analysis to this point allows us to reach to the following conclusions.

- There is near unanimity among interested parties that the major beneficial uses at Salton Sea - namely agricultural, fishing, recreational and residential/retirement should be preserved and/or enhanced;
- Benefits from effective control of salinity, flooding and pollution of the Sea are worth at least hundreds of millions of dollars and appear to justify large scale remedial investment;
- Failure to effectively manage problems at Salton Sea will place severe pressure on those agencies/entities with legal responsibility at the Sea, as subsequent adverse events occur;
- Technical alternatives that would control salinity and flooding at the Sea, are available, and at estimated levels of cost that seem justified by expected benefits.

Despite these agreed interests, available remedial opportunities, increasing financial and legal risks associated with non-remedy and the significant levels of ongoing effort evident from Table 11, it can be fairly stated that no focused program for remedy has yet been developed. Development of such a focused options program will be the target for the balance of this report.

As noted, we conclude that failure to develop a focused options program for remedy at Salton Sea cannot be principally related to disagreement on objections (most parties agree), to the issue of whether potential remedial benefits would exceed costs (they do), or to whether general remedies are technically available (they are). Rather, we believe that lack of satisfactory progress to date has been chiefly related to four causal factors.

- a disparate process that has not always focused participants energy on central objectives and related critical programs;nificant uncertainty with respect to information needed to derive a remedial strategy;
- significant investment requirements to achieve full remedial results, under any of the options posed;
- failure to spend sufficient effort and time in. developing a remedial program that deals effectively with issues of informational uncertainty and the funding process.

The remedial options plan developed here will focus particularly on these issues. Further, in attempting to get a handle on the divergent issues at Salton Sea, it is important to "start somewhere" develop a strategies focus, and then expand to further problems/issues as required. As noted, our starting place is management of salinity and flooding problems. We will then add consideration of pollution- particularly from the New River and from selenium. Our recent discussion with interested parties suggests that these are the principal issues" of present concern. We consequently feel that progress in resolving these issues will set the stage for subsequent analysis of other problems.

a) Coordination of Remedial Efforts at Salton Sea

Coordination of remedial efforts at Salton Sea had not been well developed through 1986. Interested parties came together from time to time, sometimes expending considerable effort (eg. the 1974 Task Force Report), but then returning to their respective agencies, where other requirements and responsibilities eventually prevailed. Only in 1987 did the Task Force target continuing coordination of remedial effort between interested parties as a priority. This effort has now been ongoing for almost a year. Initial progress was slow, but momentum now seems to be increasing. The Task Force will, itself, be able to judge whether progress is being made, from this draft report, from a subsequent final report, and from ongoing activities associated with our facilitative efforts. They will also be able to Judge whether progress achieved merits further action and expenditure of resources. Should the Task Force conclude that subsequent action is warranted, provision of a continuing facilitative/coordinative capability to active parties will substantially improve prospects for eventual effective remedy of the problems at Salton Sea.

b) Availability of Knowledge, the Issue of Timing and Salinity

Targets at Salton Sea

An important impediment to remedial action at Salton Sea has involved specification of salinity tolerances for the Sea's sport fishes. Whether sport species can tolerate salinity of 38,000 ppm, 41,000 ppm, or 45,000 ppm, for example, makes major differences in both the nature and scale of remedial action required. The California Department of Fish and Game is presently researching this issue, with results expected in mid-1990. In addition, we commissioned our own biological consultant, Biosystems Analysis, Inc. to review existing data on salinity tolerances, and advise us on relative magnitude of risk. Their full report as provided in Appendix G. As part of their report, Biosystems developed a judgmental range of risk concerning potential effects of salinity on Salton Sea biota. This range of risk analysis is presented in Table 12.

Table 12
Hypothetical Effects of Salinity on Salton Sea Biota

Salinity --ppm---	Event	Probability of Occurrence
40	Increased importance of environmental stress on all fish.	high
	Reproductive failure of Bairdiella, sargo, and tilapia due to excessive salinity.	moderate
	Declining abundance of primary forage for corvina due to above with resulting lower growth rates, decreased reproduction and higher mortality.	moderate
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	moderate
	Changes in lower trophic levels effecting recruitment success of corvina and other fish.	low
45	Reproductive failure of Bairdiella, sargo, and tilapia due to excessive salinity.	high
	Loss of reproduction of tilapia due to excessive salinity	moderate
	Reproduction of pileworm threatened	moderate
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	moderate
	Direct mortality to young and/or adult Bairdiella and sargo due to excessive salinity.	moderate
	Declining abundance of primary forage for corvina due to above with resulting lower growth rates, decreased reproduction and higher mortality.	moderate
	Loss of recruitment of corvina due to moderate reproductive failure at upper salinity tolerance.	moderate
	Changes in lower trophic levels effecting recruitment success of corvina.	low-moderate
50	Reproduction of Bairdiella and sargo no longer possible.	high
	Loss of reproduction of pileworm.	high
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	high
	Exceedence of upper salinity tolerance for adult sargo.	high
	Total loss of sargo.	high
	Total loss of Bairdiella.	high

	Loss of recruitment of corvina due to reproductive failure at upper salinity tolerance.	high
	Loss of forage for corvina, corvina fall to low numbers.	high
	Loss of corvina sport fishery.	high
	Reproductive failure for Tilapia.	moderate-high
	Total loss of food source for Bairdiella.	moderate
	Exceedance of upper salinity tolerance for adult Bairdiella.	moderate
55	Conditions intolerable for adult corvina due to lack of forage, corvina at very low numbers.	extreme
	Reproductive failure of Tilapia.	high
	Total loss of corvina.	moderate
	Conditions intolerable for adult corvina due to high salinity for adults.	low-moderate

Biosystems also recommended a monitoring program focusing on both target species and other important trophic elements and identified artificial propagation as a potential risk aversion strategy. All their conclusions were qualified due to a limited empirical data.

In sum, on the basis of presently available data, we conclude that continued increases in salinity at Salton Sea will eventually kill all fish life. On the basis of the Biosystems analysis, we conclude that fishery resources are at risk, given present salinity concentrations, but we cannot evaluate degree of risk or specify acceptable salinity tolerances at the Sea. It is expected that it will be possible to estimate such tolerances after completion of CF&G's ongoing work, in mid-1990.

These conclusions are important in developing remedial options at the Sea. They suggest that action can usefully be taken now (due to the presence of risk), but that such action should be incremental in nature, and not be of a scale that would over-run CF&G's expected mid-1990 results. Thus the program options developed here will concentrate first on useful interim actions, to be considered for the two year period until mid-1990, and then discuss options to achieve fuller solutions beyond that point in time. In fact, given the specific requirements f or establishing financial support for these undertakings, such an incremental strategy appears optimal o n financial grounds as well.

c) Present Status and Future Requirements for Remedial Options at Salton Sea

Following preceding discussion, explicit -consideration of remedial options at Salton Sea must be based on an evaluation of present status, of required action in the next two years, and of required action beyond that time. This status evaluation is provided, for each of the three major options considered in Table 13. Incorporated into the Table is a strategy of not making full remedial commitments until completion of CF&G1s ongoing salinity studies but using the intervening time period to do important incremental work to ready each potential option should it be chosen. This time will be critical if the feasibility of each option is to be carefully considered, and requisite funding entered into agency budget cycles, obtained from general issue of debentures, or secured by other means. Estimated funding that may be required, in monies or in "in-kind" services are presented, by period, in Table 14.

Table 13
Present Status and Required Actions -- Remedial Options at Salton

Sea

Option	Present Status	Required Action thru Mid-1990	Required Action 1991-92	Action From 1993 Forward
In-Sea impoundment.	-Option generally identified. May need to consider seismic risk.	-Update cost. -Wait for salinity targets. -Consider seismic risk.	-Implement if selected.	-Operate.
Pumpout/ Evaporation/ Solar	-Technology generally proved. Needs modular testing.	-Test a module at the Sea.	-Increase pumping and add modules if selected.	-Operate.
Gulf Waterway	-Option identified conceptually.	-Conduct reconnaissance analysis.	-Conduct feasibility analysis. -Discuss with Mexico.	-Construct if selected -Operate.

Table 14
Estimated Fiscal Dollar or In-Kind Resource Requirements--Remedial Options at Salton Sea

Option	1988-1990	1991-1992	1993 +
	---------- $ 'millions ----------		
In-Sea impoundment	.05		--125 to 140 --
Pumpout/Evaporation/ Solar	8 to 12.5		--100 to 140 --
Gulf Waterway	.1	.25	250 to 350

d) A General Strategy for-Remedial Action at Salton Sea

Incorporating previous discussion, it is possible to develop a general schematic framework for remedial decision-making at Salton Sea. Figure 1 identifies each remedial action, steps it through its required phases and times it to coincide with availability of salinity target information. It suggests a strategy for interim development of remedial options, to enable Sharper focusing and a broader decisional commitment as early as 1991, and no later than 1994. Work to address pollution issues is expected to proceed in parallel through this period.

e) Contributors to Remedial Action at Salton Sea

Past remedial dialogue at Salton Sea has featured almost universal good intent, but less in the way of commitment of actual manpower or monies. An important contractor task has been to identify which entities, if any, were prepared to actually participate in one or more of the remedial actions identified here. Using the incremental format identified in Figure 1, we have pursued this question with particular agencies. These discussions are still ongoing. On the basis of present discussions, we have identified the following entities that have indicated firm interest in contributing money and/or in kind assistance to "action teams" for particular remedial work (Table 15).

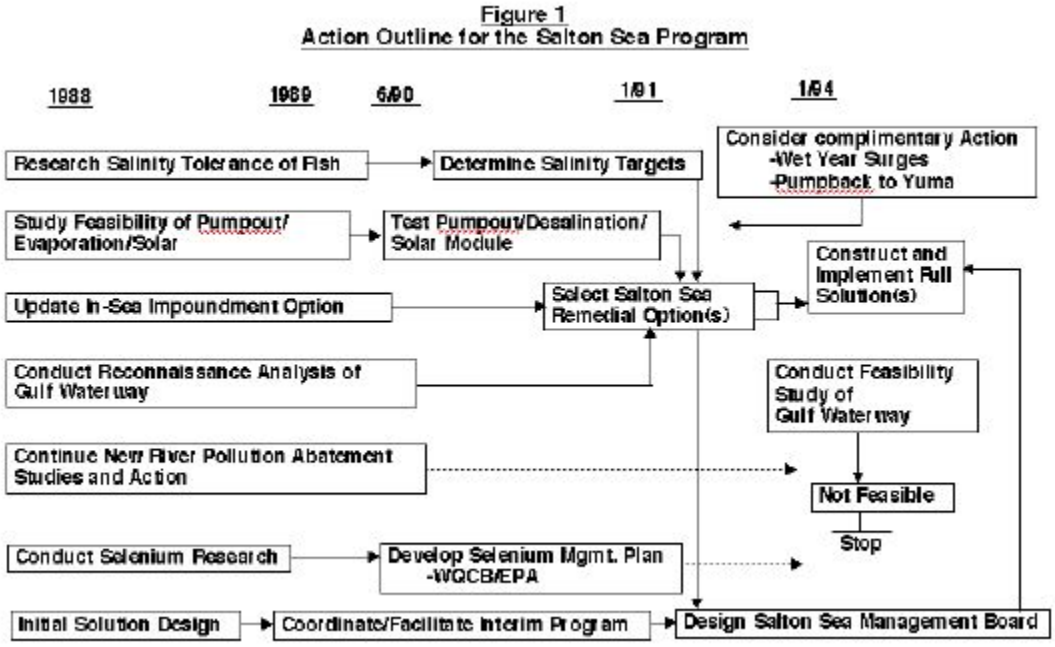


Figure 1 Action Outline for the Salton Sea Program

Table 15
Potential Participants--Remedial Action
Over the 1988-1990 Period

Action Team	Task(s)	Potential Participants
1. Salinity Standards & Water Quality	l a. Complete salinity studies for sport fish.	CF&G SWRCB RWQCB EPA FWS
2. In-Sea Impoundment	2 a. Update cost analysis.	CVWD
	2 b. Consider seismic risk issue.	
3. Pumpout/Evaporation/ Solar	3 a. Test module.	IID Imp. County ORMAT CA Energy Comm. USBR CF&G FDWR(?)WS
4. Gulf Waterway	4 a. Conduct reconnaissance analysis.	Corps USBR CF&G FWS CA. Boating &Waterway

* Preliminary, subject to revision.

The capability of each of these parties varies. Some may be in a position to directly contribute money. Others may be able to redirect ongoing progress or budgets. Still others will need to seek additional appropriations through their budget cycling process. Finally, full remedial financing may require legislative appropriation and/or debenture funding. In this sense, each Action Team, working with the coordinator, will initially need to define tasks to be undertaken over the 1988-90 period, identify the role of each contributing member with respect to those tasks and then develop an action schedule for implementation. Initial meetings for potential participants in the Solar Action Team and the Gulf Waterway Action Team are presently being arranged, and first results should be available to the Task Force by the end of August. Our present impression of the status for each of these teams is summarized in Table 16.

Table 16
Present Status of Action Teams -- Remedial Action at Salton Sea

Action Team	Agency	Status of 1988-90 Tasks
1. Salinity Standards	l a. CF&G	l a. Has resources to & Water Quality complete by mid-1990.
	1b. RWQCB SWRCB EPA FWS	l b. Continued monitoring, testing & development of water quality standards.
		lc. Interface with action teams re. requirements & funding of alternatives.
2. In-Sea Impoundment	2. CVWD	2. Will complete by mid-1990.
	3 a. IID Imp. County ORMAT	3 a. Have committed $100,000.
3. Pumpout/Evaporation/ Solar	3 b. USBR	3 b. Has committed to conduct feasibility analysis of Yuma saline return line.
	3 c. CF&G FWS	3 c. Have committed to "in-kind" participation in module design & testing .
	3 d. All team entities (see Table 15)	3 d Have agreed to explore avenues for funding support.
	3 e. All team entities	3 e. Have agreed to scope module project & assign sub-tasks .
4. Gulf Waterway	4 a. Corps	Will likely agree to conduct physical structure reconnaissance study.
	4 b. USBR	4 b. Has agreed to conduct reconnaissance evaluation of potential environmental impacts.
	4 c. CF&G	4 c. Have agreed to FWS participate CA. Boating in above & Waterways reconnaissance analysis.

On the basis of current action by interested participants, we conclude that Action Tasks (1), (2) and (4) for the 1988-90 period are both feasible, and within the committed capabilities of Action Team members. The 1988-90 module task of the Pumpout/Evaporation/Solar Team is more ambitious, and will require additional work by Team members before its completion can be fully assured. Team members have expressed a desire to proceed with that work and it is ongoing at the time of this report.

f) Feasibility of Action Beyond 1991-94

Under the interim plan developed here, relatively small financial commitments are required in early remedial stages. As salinity targets are established, and remedial options are better understood, higher levels of financial resources will be needed. In fact the Pumpout/Evaporation/Solar Team is struggling with this problem to some degree at present. It is consequently critical that active participants not only use the 1988-90 period to complete interim tasks, but also to develop an understanding of. and strategic approach to, obtaining necessary funding for option selections that are made.

Our present report provides a framework for the development of such a funding strategy and focuses on three critical issues that we believe a successful funding strategy must address.

- the strategy must be considered to be equitable;

- the strategy must target a mix of potentially available financial resources;

- the strategy must be responsible to the requirements and timing of each potential financial source.

Each of these issues is discussed below. We consider this as "opening dialogue". The Action Teams will undoubtedly wish to develop final strategies in terms of their particular needs and identified opportunities. Obtaining required funding is far more complex than "just asking for it", however and Action Teams and the Coordinator will need to work as hard in this area as in implementing their actual technical programs.

i) Equity in Supporting Remedial Action at Salton Sea

The in-Sea impoundment option is directed solely at correcting adverse salinity trends at the Sea. Both the Pumpout/Evaporation/Solar option and the Gulf Waterway option address adverse events at t h e Sea and potential benefits associated with energy and recreation/resident development, respectively. Funding responsibility for these latter two options will consequently need to be allocated between beneficial project outcomes. Further, some project beneficiary groups may have repayment capability, while others may not have. This will affect the type of funding that can be utilized. Allocation of project benefits and funding responsibilities between different project purposes is a standard government procedure. Such allocation will be a necessary part of the funding process developed by each Action Team. Preliminary calculations for the Pumpout/ Evaporation/Solar option suggest an al location of about 75% of total project cost to salinity control, 25% to energy production. These figures will need to be further considered. No similar calculation has yet been made for the Gulf Waterway option.

A second equity issue deals with the relative funding burden that might be borne by taxpayer s/residents of the general Salton Sea area, of the State of California and of the United States. Benefits to all three groups are clearly associated with alternatives posed. Impacts on economic revenue, land values, construction and employment in the Salton Sea area have been discussed in earlier sections. Significant recreation and retirement based benefits will also accrue to south coastal California and to the state as a whole. National benefits are associated with the Salton Sea National Wildlife Refuge, with the Torres Martinez Indian Reservation and with a broad spectrum of BLM land-based-responsibilities in the area. The importance of agriculture for the local area, the state and the nation has also been earlier discussed. Finally, the pumpout/evaporation/solar option offers significant energy opportunity to California and the southwestern U.S., while an international waterway to the Gulf of California would generate major state, national and international economic and recreational opportunity.

The exact sharing of funding responsibility between local, state and federal levels will need to be worked out as. options are further developed by the Action Teams and will undoubtedly involve close legislative consultation at both federal and state levels. To establish a starting point for this dialogue, we provide the following hypothetical funding frame (Table 17).

Table 17
Hypothetical Funding Framework and Requirements for Remedial Alternatives at Salton Sea

A. A HYPOTHETICAL REVENUE FRAMEWORK

Beneficiary Group	Approximate Population '000	Annual Per Capita Charge[2] $	Annual Revenue $'millions	Cumulative Charge Per Resident[3]
1. Imp. Cnty, Plus River-side Cnty. residents adjacent to Salton Sea.	128	1.00	0.1	1.50
2. California residents	26,981	.35	9.4	.50
3. United States residents	241,078	.15	36.1	.15
			---	
4. All groups			45.6	

B. AN ESTIMATE OF ANNUAL REMEDIAL REVENUE REQUIREMENTS [4]

Interest Rate [5]	Magnitude of Remedial Capital Cost			
	$ 100 million	$200 million	$300 million	$350 million
%	-------- annual amortized payment in-$-millions -------			
5	7.1	14.2	21.3	24.8
7	8.6	17.2	25.1	30.0
10	11.0	22.0	33.1	38.6
12	12.7	25.5	38.2	44.6

[1] Population estimate for Riverside County includes Coachel la, but not Indio.

[2] These charges are selected arbitrarily, to provide a basis for discussion by the Action teams.

[3] Based on the assumption that the local resident will also pay at the state and federal level; and that the state resident will also pay at the federal level.

[4] Based on a 25 year payback period.

[5] The lower 5 percent range of interest is presented to reflect special "low interest" loans programs.

Not all these revenues would necessarily come from government sources. User fees and land assessment based levies provide two examples of alternative methods for revenue generation that may be tied to remedial efforts at Salton Sea. What Table 17 indicates is that, overall, the magnitude of revenues that may be required for full remedy at Salton Sea can likely be achieved at nominal overall per capital cost. As noted earlier, the exact magnitude of costs, and cost sharing formulas between local, state and federal entities and between users, environmental protection and non-users will need to be further clarified as Action Team efforts continue.

ii) Potential Fiscal Resources Available to Remedial Work at Salton Sea

A broad range of resources are potentially available to support remedial work at Salton Sea. During the interim 1988-90 period, where requirements are relatively modest, a significant component of required resources may be provided "in-kind either by reprioritizing effort or by focusing ongoing programs within interested agencies. The reconnaissance analysis of the Gulf Waterway option is an example of such a commitment. As remedial options develop, are related to salinity targets, require testing, and if selected, are developed, need for direct funding will accelerate.

Large amounts of money are generally not available from government sources "for the asking". Certainly, some authorized and not yet encumbered monies are available, and these will need to be targeted in the remedial process. Increasingly, in times of fiscal constraint, it will be necessary to adopt a mixed funding strategy, that targets a broad range of revenue sources to enable required remedial action. The required process is generally described in Figure 2.

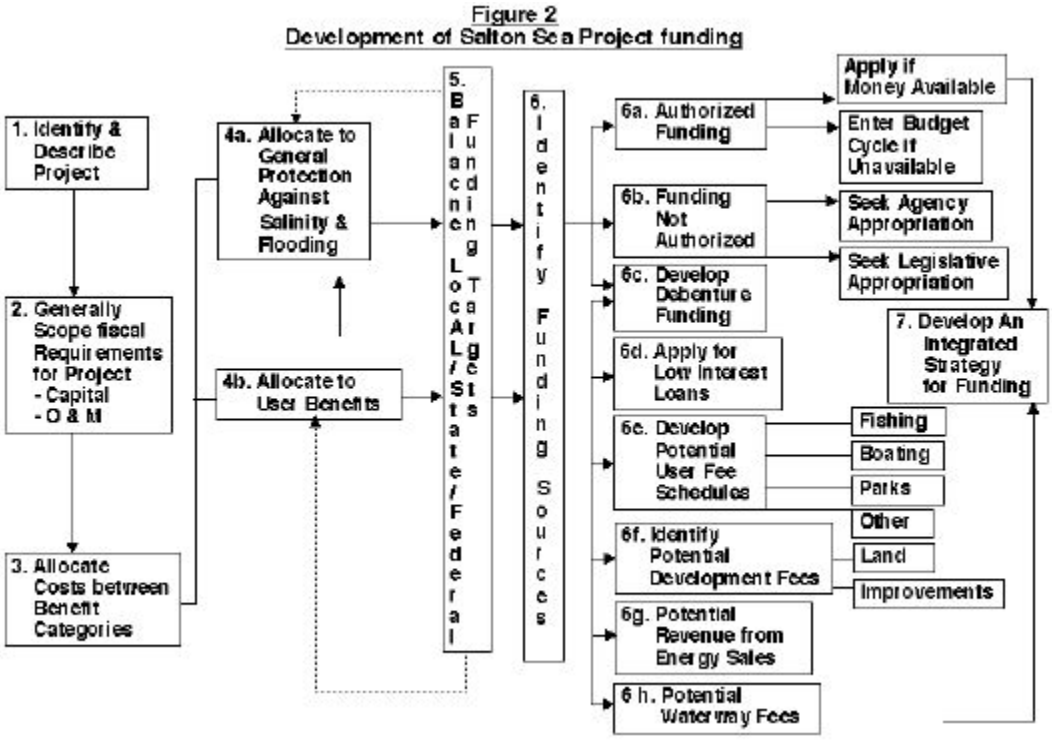


Figure 2 Development of Salton Se Project Funding

It can by observed from Figure 2 that development of funding capability is a task of equivalent importance to identification of required remedial need at Salton Sea. Moreover, it will be closely tied to the scale and timing of technical response; and to allocation of funding responsibility between geographic constituencies, and between users and the general public. Some funds are available, and these can be applied for. It is even possible that funding may eventually come from a single source. It is more likely, however, that a mixed funding strategy will succeed: targeting existing funds where available; entering future-year budget cycles of interested agencies; seeking legislative appropriations were appropriate; specifying fee structures for project revenue generation, and tying expected revenue to low interest loan applications; considering debenture options, both to meet general environmental obligations and to enable recoverable user benefits.

Formulation of the ACTION TEAMS for each alternative provides the necessary first stop for development of a funding strategy. As remedial options are firmed, the following steps of allocating costs to beneficiary groups, of identifying and developing funding sources and of integrating these approaches to obtain the full measure of funding required can proceed. It is our view that continued coordinated effort along these lines will result in substantial progress through the 1988-90 interim period so that at the next recommended major decision point (see Figure 1), the Task Force will have a very firm picture of potential funding that may be associated with

each considered option, and of the means and probability of obtaining it. Hence, we recommend that timing associated with development of revenue sources be tied to overall timing with respect to remedial project development at the Sea. The present status, scheduling and immediate funding needs for each identified remedial option are generally linked to potential funding sources, as we have been able to identify them, in Table 18.

Table 18
Funding Potentials Associated with Remedial Options at Salton Sea

Remedial Options	Present Funding Status	Required FundingAction
1. Water Quality/ Salinity targeting	l a. Salinity funding committed by CF&G.	l a. Generally OK for salinity targeting.
	l b. Selenium sources study funded by RWQCB.	l b. ?
	l c. Pollution project options at New River under consideration by SWRCB.	l c. Need funding from SWRCB. Consider possible Clean Water Act planning support (205J-2; 205J-5).
2. In-Sea Impoundment	2 a. Cost update to 1990 covered by CVWD. CWA 205J-2 and 205J-5 planning monies might assist in 1990.	2 a. Develop potential funding sources post-1990. Consider budget cycles re. EPA, USBR, and State levels.
3. Pumpout/Evaporation/ Solar	3 a. Imperial County/ IID/ ORMAT have committed $100,000.	3 a. Need $8-12 million for modular testing.
	3 b. USBR has committed feasibility analysis on a Yuma high-salinity return line.	3 b. Apply directly to SWCB for Title 2 grant monies under Clean Water Act (requires SWRCB action)
	3 c. CF&G, FWS, USBR, EC have committed technical assistance.	3 c. Target CA. Energy Comm. Energy Partnership Program. (Application process is ongoing).
4. Gulf Waterway	4 a. U.S. Army Corps is negotiating to do construction reconnaissance analysis.	4 a. Appears OK through 1990.
	4 b. USBR will do impact reconnaissanceanalysis.	4 b. Discuss contribution options with Action Team members, and initiate action in their budget cycle processes.
	4 c. CF&G, FWS and CA. Boating & Waterways will participate technically in 4a &	4 c. Consider future legislative appropriation needs.

4b.

Integration of Figure 2 and Table 18 provides a focus for development of requisite remedial funding. As noted, an effective funding strategy must be tied to requirements of the remedial alternatives as they progress. At present, it appears that financial resources required by the Water Quality Team (for salinity work), the In-Sea Impoundment Team and the Gulf Waterway Team will be available to proceed with required work through 1990. The Pumpout/Evaporation/ Solar Team is now ready for modular testing and development. Their financial needs are consequently larger and will require intensive effort targeting funding sources and actions from Table 18. This effort will need to be a major focus of Team activity over the balance of 1988.

Finally, a number of low interest loans and debenture programs are available from federal and state sources. These must necessarily be tied to revenue recovery, however. Revenue may be recovered through fees, local assessments on land and improvements (subject to limits imposed by Proposition 13) and via related procedures. Action Team resolution of the issues identified in Figure 2 is a necessary prerequisite to effective incorporation of revenue generation and the use of loans/debentures for remedial funding.

2. Options for Improvement at Salton Sea--A Conclusion

The clients who retained us to facilitate remedy at Salton Sea asked us a series of principal questions.

i) Was there any consensus among interested parties as to what purposes the Sea should serve?

ii) Were there any technically feasible solutions to remedy major problems at the Sea particularly those associated with increasing salinity and with flooding? iii) Were these solutions affordable, in the general sense that benefits could be seen to outweigh costs?

iv) What interested parties, if any, were prepared to go beyond expressions of support to contribute actual monies and/or loin kind" support to achieve one or more of the remedies identified?

v) Could a feasible organizational plan be developed to pursue any practical remedial opportunities that were identified?

Consideration of the information provided in t his report suggests that the answer to each of the first four questions posed is "yes". Discussion with parties to the Salton Sea Task Force identified a near unanimous consensus with respect to objectives at Salton Sea. We have been able to identify three technical alternatives that, taken separately or in combination, appear capable of controlling salinity and flooding problems at the Sea. Further, based on available information, the anticipated benefits from such remedy would greatly outweigh anticipated costs.

At the time of writing thirteen (13) federal, state and local agencies/interests have made specific commitments to assist in Action Team development of remedial alternatives and associated required funding. As a result, successful completion of the 1988-90 interim tasks identified in Figure 1 seems assured for the Salinity Targets, In-Sea Impoundment and Gulf Waterway Tasks and three entities have already dedi cated initial monies toward development of the Pumpout/ Evaporation/ Solar option. Several other agencies/interests are presently considering entry to one or more of the Action Teams. Should the Task Force wish to proceed, formation of these Action Teams provides the obvious key, both to further development of project remedy and associated sources of funding over the 1988-90 period.

Adoption of an incremental strategy of doing needed work in the 1988-90 period and then subsequently selecting and developing fuller remedial response, aligns three important time requirements for effective remedy at Salton Sea.

- it provides time to understand and recommend target salinity requirements;

- it provides time to do necessary reconnaissance/feasibility work for some of the options identified, and to sensitize them to salinity targets when they become available;

- it provides time to develop the kind of sophisticated, project specific, funding approach that is required for undertakings of this potential magnitude.

Finally, we were asked to identify potential organizational options to be associated with remedy at Salton Sea. That issue is discussed in our final following section.

10. Organizational Options Associated with Remedy at Salton Sea

a. Timing for Resolution of Organizational Issues -

Our report has recommended conduct of interim activity through 1990, when salinity targets can be established, subsequent scoping of a final remedial strategy and then development of a full remedial response. In the context of this logical sequencing, we believe it premature to consider establishment of a permanent new organization for remedy and resource management at Salton Sea at this time. Until the shape of a full remedial strategy has been specified, it is impossible to properly identify all principal players and/or revenue providers. These will be important issues affecting organizational structure. It is our consequent recommendation that consideration of permanent organizational structure be deferred until 1991. Several options are available in the interim 1988-90 period, however, and they will be identified here.

b) Focus of Organization Discussion

Readers will have noted that we are generally optimistic that a satisfactory remedy can progressively be achieved at Salton Sea. With that in mind, we must be aware of the old organizational adage, "if it works don't fix it". Our discussion here consequently starts from the basis of the present Task Force/Working Group/Facilitator arrangement, and considers potential amendments to that organization frame. In general, our discussion will address four central issues: overall leadership of remedial efforts at Salton Sea over the 1988-90 period; efficiency needs in maintaining momentum for a solution at Salton Sea; the need to develop a coordinated funding plan concurrently with technical options to remedy Sea problems; and the need to provide continuing information and input opportunity for generally interested parties and the public at large.

i) Organizational Leadership in the Interim 1988-90 Period

At present, remedial efforts at Salton Sea have been overviewed by The Resources Agency. Situated midway between local and federal interest, and encompassing both economic and ecological concern, we consider this agency well suited for such a role. Once remedies have been developed, there may be strong arguments for moving leadership closer to operational locations. As noted, however, we are not there yet, and we believe The Resources Agency can continue to provide an important balancing role, particularly with respect to some of the issues identified in Figure 2. If a change is desired, we view the State Water Resources Control Board as the most attractive alternative agency to play an integrating role. The Board is similarly Positioned to The Resources Agency, and review it as a next best choice for overview responsibility, should a change be required for the 1988-90 period.

ii) Efficiency in Maintaining Remedial Momentum at Salton Sea

Formation of Action Teams focusing on each interim task provides a logical next step in hands-on development of remedial options. Each team would consist only of these interests who committed funding and/or technical assistance to development of the particular targeted option. In this sense, each Action Team would be smaller and more focused than the present full Task Force Working Group, and would provide technical and

management capability to proceed expeditiously with remedial development.

We recommend that each Action Team continue to be serviced by a coordinator/facilitator, who would serve as secretary to the group, provide substantive assistance in development of an overall funding strategy, and liaise between groups and with Task Force leadership. We recommend that the facilitator also prepare a progress report for each working group every 4 months, to be submitted and discussed at a meeting of the full Task Force. We propose that the Task Force be composed of the members of the four Action Teams.

iii) Need for a Coordinated Funding Plan

As noted earlier, while some agency personnel possess considerable knowledge respecting funding opportunities and processes within their particular jurisdiction, development of a workable funding strategy has lagged behind problem identification and technical analysis of options in work to date at Salton Sea. This was perhaps appropriate in earlier years. It is clear, however, that this deficiency must be remedied if identified remedial opportunities are to be realized. We have presented a framework for such remedy in Figure 2. We believe it unlikely that an integrated funding 'Plan will result automatically from deliberations of each Action Team. We consequently recommend that development of a strategic plan for acquisition of requisite funds be designated as an explicit responsibility of the coordinator/facilitator.

vi) Information/Access for Other Interested Parties

The Salton Sea is a public resource. Resolution of problems at the Sea will entail significant public costs and will generate ever greater public benefits. It is consequently important to maintain communication with these entities/individuals who are not in a position to contribute substantially to any of the action identified, but wish to be kept informed of remedial progress. To this end, we recommend retention of the broad based listing of interested entities and individuals both for circulation of written progress information, and to attend general informational meetings at the call of the Task Force Chair.

v) A Summary of Organization options - for the 1988-90 Period

Foregoing discussion enables development of three organizational options for the 1988-90 period. The present organizational arrangement is outlined in Figure 3. Our recommended options incorporating Action Teams, a streamlining of the actual Task Force, and creation of a broader Task Force Advisory Group is presented in Figure 4.

Finally, coordinative support is removed in Figure 5. This is essentially the situation when the Task Force is inactive and is not recommended.

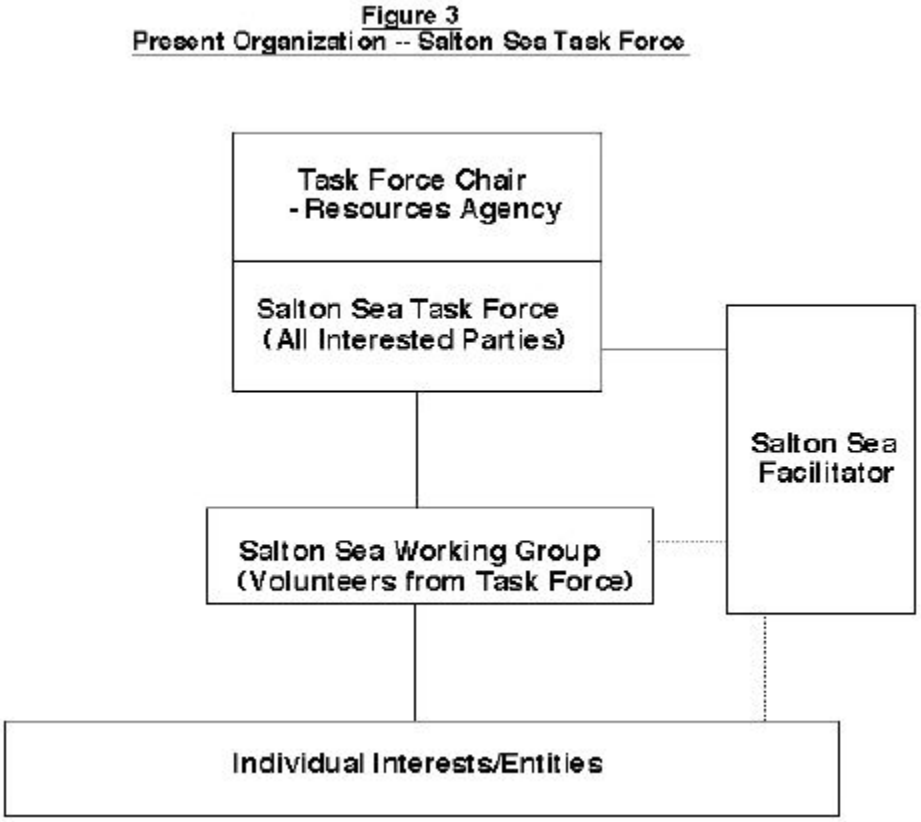


Figure 3 Present Organization -- Salton Sea Task Force

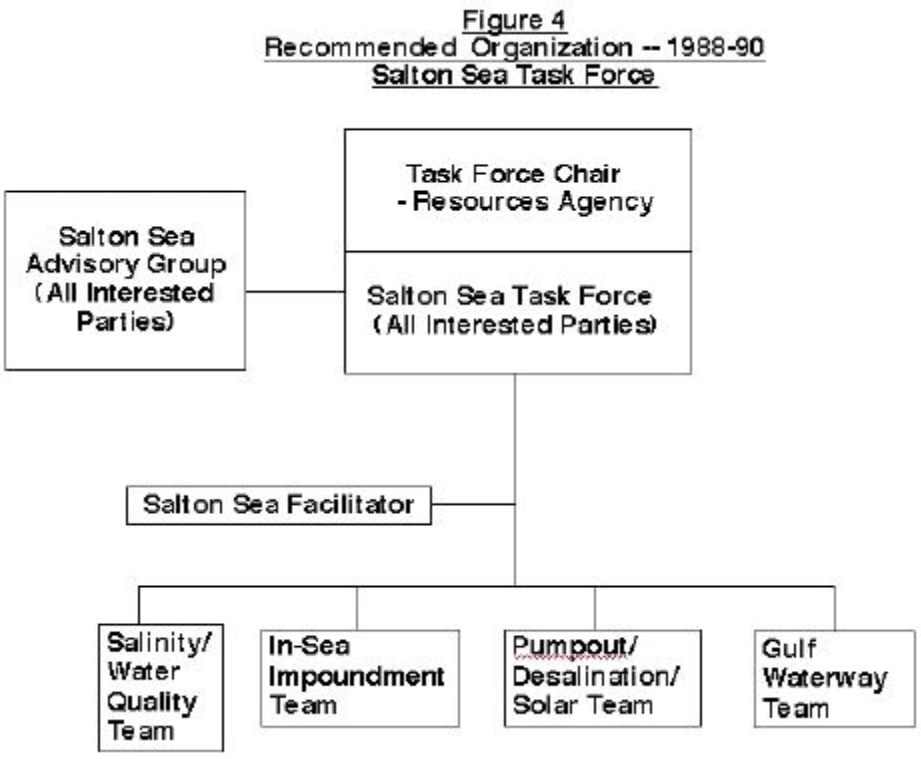


Figure 4 Recommended Organization -- 1988-90, Salton Sea Task Force

Figure 5
Uncoordinated Alternative-Salton Sea Remedial Work

Figure 5 Uncoordinated Alternative-Salton Sea remedial Work

Appendix A
Historic Salton Sea Water Budget

			Water Balance (1,000 AF)			
Year[a]	Elevation Below Sea Level (ft)[b]	Surface Area (1,000 acres)[c]	Inflow[d]	Direct Rain[e]	Evaporation[f]	Change in Storage[g]
1949	240.2	---	---	---	---	
1950	239.6	198	1,203	4	1,090	+ 117
1951	238.3	204	1,358	30	1,160	+228
1952	236.6	211	1,411	45	1,140	+316
1953	235.8	216	1,456	1	1,260	+197
1954	234.8	221	1,365	24	1,170	+219
1955	234.4	223	1,371	18	1,290	+ 99
1956	234.5	222	1,310	2	1,330	- 18
1957	234.5	222	1,193	33	1,210	+ 16
1958	234.6	222	1,187	40	1,230	- 3
1959	234.3	223	1,300	33	1,280	+ 53
1960	233.8	224	1,387	36	1,310	+113
1961	233.4	225	1,413	34	1,360	+ 87
1962	232.7	227	1,469	23	1,330	+162
1963	231.2	231	1,644	57	1,380	+321
1964	231.9	230	1,212	10	1,357	-135
1965	232.0	229	1,164	49	1,259	- 46
1966	232.0	229	1,312	19	1,308	+ 23
1967	231.8	230	1,321	59	1,335	+ 45
1968	231.8	230	1,399	31	1,430	0
1969	232.0	230	1,392	22	1,414	0
1970	231.9	230	1,270	21	1,291	0
1971	231.7	231	1,309	23	1,263	+ 69
1972	231.3	232	1,317	25	1,264	+ 78

1973	231.2	233	1,354	18	1,310	+ 62
1974	230.7	234	1,446	56	1,388	+114
1975	230.1	236	1,475	14	1,337	+152
1976	228.6	239	1,490	144	1,329	+305
1977	228.3	240	1,466	67	1,461	+ 72
1978	228.2	240	1,507	125	1,629	+ 3
1979	227.8	242	1,593	74	1,563	+104
1980	227.3	243	1,475	89	1,448	+116
1981	227.4	242	1,292	49	1,385	- 44
1982	165.6	242	1,194	63	1,300	- 43
1983	226.6	244	1,485	165	1,407	+243
1984	226.7	244	1,392	55	1,408	- 24

[a] Calendar year.

[b] IID record of station Near Fig Tree John Spring.

[c] Salton Sea area in thousands of acres.

[d] Computed inflow to balance hydrologic equation. Inflow equals change i storage plus evaporation, less direct rainfall.

[e] Direct rain is computed as area time average rainfall as measured at f three stations near the sea.

[f] Evaporation is pan evaporation (average of three stations) times pan 9 coefficient of 0.69 times surface area.

[g] Determined from chanqe in elevations and area-capacitv relationship.

Appendix B
Components of Inflow to Salton Sea (1,000 AF)

Year[a]	IID/Coachella[b]	Mexico[c]	Other[d]	Total[e]
1950	1,158	45	0	1,203
1951	1,265	44	49	1,358
1952	1,335	44	32	1,411
1953	1,397	39	30	1,456
1954	1,333	38	-6	1,365
1955	1,143	56	172	1,371
1956	1,151	85	74	1,310
1957	1,052	80	61	1,193
1958	1,018	113	56	1,187
1959	1,066	131	103	1,300
1960	1,118	130	139	1,387
1961	1,123	124	166	1,413
1962	1,190	141	138	1,469
1963	1,275	148	221	1,644
1964	1,014	113	85	1,212
1965	1,008	120	36	1,164
1966	1,124	112	76	1,312
1967	1,145	105	71	1,321
1968	1,125	114	160	1,399
1969	1,093	112	187	1,392

1970	1,139	108	23	1,270
1971	1,219	116	-26	1,309
1972	1,200	120	-3	1,317
1973	1,216	126	12	1,354
1974	1,268	120	58	1,446
1975	1,290	108	77	1,475
1976	1,248	111	31	1,490
1977	1,166	116	184	1,466
1978	1,128	107	272	1,507
1979	1,196	153	244	1,593
1980	1,175	165	135	1,475
1981	1,108	165	19	1,292
1982	1,029	166	-1	1,194
1983	1,006	252	227	1,485
1984	1,124	277	28	1,329

[a] Calendar year

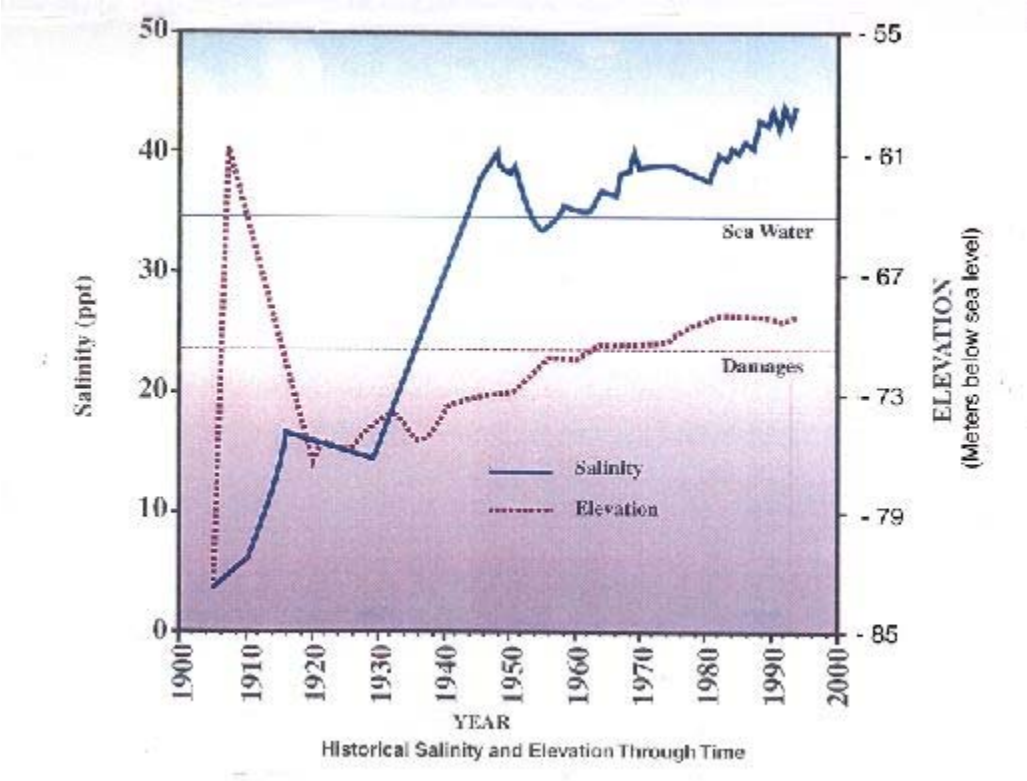
[b] IID amount includes measured inflow in New and Alamo Rivers, less surface and subsurface inflow from Mexico at the International Boundary, plus estimated inflow from drains that empty directly to the sea. Coachella inflow was that reported by the USGS (1950-1972). c From 1973 through 1984, amounts are from the CVWD.

[c] Inflow in New and Alamo Rivers measured at International Boundary, plus subsurface inflow.

[d] Amount to balance table and includes storm inflow and subsurface inflow.

[e] Total inflow computed from water balance of Salton Sea. Source: Parsons, 1985.

Appendix C
Historical Change to Salton Sea Salinity and Elevation (B-E, 1985)



Sea Salinity = 35 ppt

Notes (Original Figure)

1. End of year elevations near fig tree John Spring. (I.I.D. Data)

2. Average of samples at four or five stations taken in May and November by I.I.D.

Source: Parsons (1985)

Appendix D
Comments on Salton Sea
by the U.S. Environmental Protection Agency

Enclosure 1 - Future Uses of the Salton Sea and Adjacent Shoreline

1. Receive Agricultural Drainwater

EPA recognizes that the majority of flows into the Salton Sea are from agricultural drainwater and that the poor quality of this water is impacting the existing instream uses. However, the question of whether or not the Salton Sea should receive agricultural drainwater is basically a water rights issue and beyond the jurisdictional authority of the Federal Clean Water Act (CWA).

EPA's direct involvement is through the approval of State adopted water quality standards (WQS) for the Salton Sea (Section 303(c) of the CWA). Water quality standards are provisions of the State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria to protect the uses . The State Water Resources Control Board (SWRCB) has adopted 21 standard beneficial uses that cover the uses identified in Section 303(c)(2)(A) of the CWA. Beneficial use designations for Habitat (WILD), Water

Contact Recreation (REC-1), and Non-Contact Water Recreation (REC-2). The use of the Salton Sea as a depository for agricultural drainwater cannot be considered a "designated Use" for purposes of implementing the CWA (40 CFR 131.10).

EPA approval of State-adopted WQS submittals is based in part on a determination that the WQS reflect the uses presently being attained and include water quality criteria sufficient to protect the designated uses. Federal requirements for establishing WQS are described in 40 CFR 131.

In summary, EPA is primarily concerned with the quality of the agricultural drainwater rather than the transport of such water to the Salton Sea.

2. Shoreline Residential Area

EPA does not have an Agency position on this use.

3. Boating and Swimming and Associated Businesses

Boating and swimming are included under REC-1 a designated use of the Salton Sea. As mentioned above, EPA approval of WOS submittals includes a determination that the water quality ' criteria are sufficient to protect the designated uses. Federal antidegradation policy requires that existing uses be protected and maintained (40 CFR 131.12). EPA does not have an agency position in regards to businesses associated with swimming and boating activities.

4. Fishing and Associated Businesses

In the Colorado River Basin Region fishing is listed under REC-2 which has no use-specific water quality criteria to protect public health. The Regional Board is currently conducting a triennial review of WQS for the Colorado River Basin in accordance with Section 303(c)(1) of the CWA. EPA review and approval of the triennial review will include an evaluation of whether the existing or proposed water quality objectives are sufficient to protect the REC-2 use in the Salton Sea and other water bodies in the region. EPA does not have an agency position in regards to businesses associated with fishing.

5. Parks and Wildlife Areas

Parks and wildlife areas along the Salton Sea provide water related recreational opportunities and provide habitat for and enhance protection for aquatic life and other wildlife species, all of which are designated uses of the water body. These land uses are compatible with goal of the CWA to attain water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water (Section 101(a)(20).

6. Depository for Treated and Untreated Waste

EPA regulatory authority to control discharges of treated and untreated waste in the Salton Sea depends on whether the discharge is from a point source or a nonpoint source. The CWA defines the term "point source" as any discernible, confined and discrete conveyance from which pollutants are or may be discharged. The discharge for any pollutant from a point source to navigable waters is regulated under a National Pollutant Discharge Elimination System (NPDES) permit (Section 402 of the CWA).

NPDES permits cover the discharge of treated as well as untreated waste materials. Effluent limitations established in the permit must meet the applicable WQS. In California, EPA has oversight authority for the approval of NPDES permits issued by the State. Agricultural return flows are specifically exempted from this permit requirement (Section 402(l)(1) of the CWA) and are considered a nonpoint source (NPS) of pollution under the CWA.

The Salton Sea is designated a water quality limited segment (WQLS) indicating that is known that the water quality does not meet applicable WQS. As a result, the State is required to conduct a total maximum daily load (TMDL) or the Salton Sea which allocates pollutant loadings from point and non-point sources at levels necessary to attain and maintain the applicable narrative and numerical WQS (40 CFR 130.7). EPA has oversight authority for the approval of TMDLs submitted by the State. Implementation of this Federal requirement would affect future discharges of pollutants into the Salton Sea.

7. EPA does not have an agency position in regards to the four remaining uses listed in Table 1. However, if any of these activities involve discharge of pollutants including dredged or fill materials into navigable waters, Federal permits under Section 402 and/or Section 404 of the CWA would be required. EPA has oversight authority for the issuance of these permits.

Enclosure 2 - Future Actions at Salton Sea

1. Control Sea Salinity to Preserve Fish Life

Increasing salinity levels in the Salton Sea will, at some point, impact the aquatic life, including the sportfish species. During the triennial review of WQS for the Colorado River Basin, EPA has recommended that the California Regional Water Quality Board (CRWQCB) adopt a water quality objective for salinity that reflects the salinity tolerances of Salton Sea sportfish.

WQS submittals must comply with the Federal antidegradation policy which requires at a minimum the full protection of existing uses, including WARM (40 CFR 131.6). As mentioned earl ier, EPA has oversight authority for the review and approval of WQS revisions.

2. Turn Sea Into a Waste Depository

Refer to comments numbers 1 and 6 of Enclosure 1.

3. Treat New River Pollution from Mexico

Source control of pollutant loadings to the New River in Mexicali, Mexico, is needed to significantly improve the water quality of this water body. In August 1983, Presidents Reagan and de la Madrid signed the U.S.-Mexico Border Environment Agreement. The Agreement committed both governments to cooperate fully in the protection and improvement of the environment within 100 kilometers on either side of the border. It designated EPA in the U.S. and the Secretariat for Urban Development and Ecology (SEDUE) in Mexico as the two coordinating agencies.

EPA strategy to date has been to continue encouraging Mexico to proceed with their program of eliminating industrial, agricultural, and other nonpoint source discharges to the New River, and improving their municipal treatment works.

4. Develop Effective Techniques for Control of Selenium

The 1987 amendments to the CWA require the CRWQCB to adopt numerical criteria for selenium to protect aquatic life and public health (Section 303(c) (2) (8)). EPA has oversight authority for the approval of such a WQS revision.

Loadings of selenium into the Salton Sea originate from nonpoint sources. Measures for controlling levels of selenium in the Salton Sea, as well as other affected water bodies in the Colorado River Basin, need to be identified in the State NPS Management Program which will be submitted to EPA for approval (Section 319(b) of the CWA).

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Basin-Delta Mothersite Salton Sea Home Page

APPENDIX F

SUMMARY ANALYSIS OF AUTHORITIES AND RESPONSIBILITIES ASSOCIATED WITH THE SALTON SEA

Prepared for Meyer Resources, Inc.

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July, 1988

SALTON SEA STUDY
INSTITUTIONAL LEGAL ANALYSIS

Table of Contents

SALTON SEA STUDY

INSTITUTIONAL LEGAL ANALYSIS

I. Introduction

This report is intended to set forth a summary of the institutional and legal structure and requirements which will apply to the primary Salton Sea management options being considered in the Salton Sea study.

The principal management options included in the course of the institutional and legal analysis are summarized in the section which follows. Based upon these very general assumptions as to the nature and location of the management actions, the agencies discussed in Section IV were surveyed.

For each agency, a list of "triggering factors" was reviewed to determine how each of the management options would provoke the agency's involvement in approving, implementing or commenting upon a proposed management action. These factors are summarized in Table 1.

In addition to the agency review, the report includes a summary of other legal constraints that would affect all proposed actions. These are set forth in Section III.

The analysis included in this report is intended as a preliminary survey to establish within available time and resources the legal and institutional setting in which the management options must be considered. Both time and informational constraints necessitated the elimination of certain agencies from this analysis. However, a brief discussion of the rationale for the exclusion of some of these agencies is merited and is included in Section

III.F.

Table 1

Triggering Factors for Agency Involvement

1. Management responsibility or ownership of specific geographical areas.
2.Change in a discharge of water or pollutant.
3.Change in pollution levels.
4.Potential for harm or death to fish and wildlife, including migratory birds.
5.Increase or decrease in water flow.
6.Flooding or rescission of water levels.
7.Creation of a solid or hazardous waste requiring disposal.
8.Production and/or transmission of electrical energy.
9.Physical entry into water or onto land for construction of project facilities.
10.Crossing of international borders.
11.Management Expertise.

II. Summary of the Principal Alternatives

Four principal management alternatives provided the factual assumptions for the legal and institutional analysis. A brief summary of these alternative scenarios is set forth in this section. The summary of the in-sea impoundment option was based upon the description of this alternative presented in the Draft Environmental Impact Statement, Salton Sea Project (1974), prepared by the Department of Interior and the Resources Agency of the State of California. The summaries of the other alternatives analyzed in this report were based upon descriptions of these alternatives that evolved through discussions of the alternatives during the compilation of this report. The various alternative approaches to Salton Sea problems involve different mixes of agency responsibility and action. Each approach, or variant, creates different intersections with existing local state, tribal, federal and international governmental authority. Similarly, each variant may highlight different gaps in existing authority that need filling before implementation could be achieved. What follows is a brief description of the major features of the alternatives which could either implicate existing agency authority or promote a legislative grant of new agency authority.

A. No Action Alternative

Some decrease in flooding will likely occur following implementation of management actions required by State Water Resources Control Board Decision 1600 concerning the water conservation practices of the Imperial Irrigation District (II D). The salinity levels in the sea would continue to increase due to the evaporation of water. This increase could be exacerbated by decreased water inflow since less water would be available to dilute the salts in the sea. Pollution levels will also increase relative to the total volume of water in the sea.

Several agencies may become involved in the issues confronting the Salton Sea, either voluntarily or involuntarily, should the "no action" alternative be pursued. The rise in the level of salinity and pollution relative to the amount of water that will continue to flow into the sea will trigger the management responsibility of agencies charged with the duty to protect natural resources and the wildlife that depend on those resources. Agencies with responsibility over the discharge of waters and pollutants have also been examined to determine the relationship between their statutory duties and the increase in the problems associated with the Salton Sea.

Table1

A Summary of Principal Agency Authorities and Responsibilities, Should Adverse Trends at Salton Sea Continue

Adverse Trends	Triggering Event	Principal Responsible Agencies
1. Salinity Continues to increase	1a. Exceeds specified standard (s)	-RWQCB -SWRCB -EPA -USBR*
	1b. Adversely affects fish and wildlife	-CF&G -FWS -RWQCB -SWRCB
2. Pollution at unsatisfactory levels	2a. Exceeds health standards	-CA Dept. of Health Services -RWQCB -SWRCB -EPA -Gov't of Mexico -Int'l Boundaary & Water Comm. -USBR*
	2b. Adversely affects fish or wildlife	-CF&G -FWS
3. Water levels at the Sea Increase	3a. Flooding	-SWRCB -IID -CVWD -Imp. County -Riverside Cty. -CA Parks & Rec. -USBR*

*The scope of USBR involvement cannot be definitively stated at this stage. See section IV.B.1.a.

Salinity Increase. State and federal salinity standards could be violated, involving the Regional Water Quality Control Board (RWQCB), State Water Resources Control Board (SWRCB) and the Environmental Protection Agency (EPA). The salt water fishery would gradually or dramatically decline, along with the water fowl that rely upon the fishery for their existence. This decline might violate the State Fish and Game Code and federal wildlife provisions. The California Department of Fish and Game (DF&G) and federal Fish and Wildlife Service (F&WS) would consequently become involved. In addition, recreation-dependent businesses might seek common law remedies for damages.

Pollution Increase. State and federal water quality standards could be violated. If pollution continues to worsen and migratory water fowl are adversely affected, international treaties may also be violated. DF&G and F&WS would again become involved. Closures of part or all of the Sea for body contact recreation or sport fishing could occur, involving the State Department of Health Services and the county health department, RWQCBs, SWRCB, and the State Department of Parks and Recreation. Violations of state and federal water quality standards could occur or be exacerbated, involving the Environmental Protection Agency, SWRCB and RWQCBs. International negotiations involving the International Boundary and Water Commission, U.S. Department of State, Mexican Government and Mexicale Valley governments could be provoked by the degradation of the New River. Public health and private party impacts could lead to personal injury litigation.

Water Level. The litigation by private landowners against the CVWD and IID, and between those districts, which started in the late 1970's, will continue. The flooded state park may be restored and private resorts revised as waters recede. Shoreline land use regulations by county and tribal authorities may restrict development in the light of the recent flood experience.

The adverse trends, associated triggering mechanisms, and principle agencies likely to become involved under the No Action alternative are summarized in Table 2.

B. In-Sea Impoundment

A 37 mile dike would be constructed in the southeast end of the Sea. The dike would completely enclose an area of approximately 50 square miles, forming an impoundment area. Both the construction and operation of the impoundment would be subject to the review of various state and federal agencies. Two gates would permit the flow of water into and out of the impoundment. The dike would be located between one half mile and one mile from the shore of the sea. Saline water from the Sea would be diverted into the impoundment and evaporated. The diversion of water might activate the authority of those agencies with responsibility for the regulation of appropriation and diversion of water.

Impoundment of the water prior to evaporation will permit the isolation of salt residues and will prevent the mixing of salt residues with the remaining water in the sea. The salt residues will be stored in the impoundment for an undetermined period of time. It is not currently known how the residual salts will be managed once the impoundment reaches capacity or the level of salt in the Sea has stabilized. Storage of the salt and other residual components of the water may be regulated as the storage or disposal of a solid waste.

The rate of sea water evaporation should be unaffected. Therefore, there should be no significant water level fluctuation attributable to the construction and operation of the impoundment.

The area of the impoundment between the shoreward side of the dike and the New and Alamo Rivers will form a freshwater channel. Two causeways will connect the impoundment to the shore of the lake. The causeways are solid structures that form a wall between the channel area and the remaining sea. Each of the causeways will have a bridge allowing the passage of small vessels. The causeway will not connect with state park land or federal wildlife refuges on the shore of the sea.

The continuing freshwater inflow from the New and Alamo Rivers will dilute the salinity level in the area of the sea outside the impoundment. Diversion of saline water to the impoundment may also have the effect of increasing the concentration of pollutants in the channel area. However, it is unclear whether the physical structures creating the channel will inhibit the flow of the New and Alamo River waters into the main body of the sea, resulting in an elevated pollution level in the channel due to decreased mixing and dilution.

Two wildlife refuges are located in the vicinity of the dike and the channel. If pollution in the channel should rise as a result of the impoundment, the proximity of the channel to the refuges could also have a negative impact on the wildlife sanctuaries. Agencies concerned with the protection of fish and wildlife, as well as the agencies responsible for the operation and protection of the refuges, would therefore have a role in the formulation of a safe impoundment plan.

The channel area would require constant dredging to remove silt deposited by the New and Alamo Rivers. The dredged material may be used to create an expanded wildlife habitat. If this plan cannot be carried out, it will be necessary to dispose of the dredged material in another manner, such as disposal to a landfill or into other portions of the sea.

California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) would require environmental impact analysis, reporting and commenting. The value of the shoreline abutting the pond would be diminished for residential/recreational purposes. The reduction in habitat area for fish and water fowl could be a matter of DPAG and F&WS concern.

C. Pump out/Evaporation/solar Generation

This alternative would involve the dedication of existing public land or the acquisition of private land for use as

an evaporation site and solar power production facility.

A pump would be constructed on land adjacent to the sea shore Identification of the agencies with responsibility over this aspect of the project, and the degree to which the agency would be involved, is dependent in part upon the ultimate location of the pump. Water would be pumped through a pipeline to a vertical evaporation process area. Construction of the pipeline would again require agency approval.

The process area will be located in close proximity to the Salton Sea. A vertical evaporation process would dispose of much of the water diverted from the sea. The remaining residual materials and briny water would be stored in ponds and used to generate solar energy. The solar energy plant, as presently contemplated, would be initiated with the construction of a module capable of producing an estimated 2.5 megawatts of energy. However, as the amount of water in the ponds increases, the capacity of the plant would be expanded in 2.5 MW increments. The ultimate capacity of the plant is estimated to be 25 MW per year.

It might be necessary to arrange for the disposal of the briny waters at two phases of the project. First, during the early stages of project operation, briny water may be produced at levels in excess of the solar facility's ability to utilize the waters. Second, once the plant reaches its capacity, residual water from the vertical evaporation process may have to be disposed of elsewhere.

D. Gulf Waterway option

A navigable waterway system would be built which would cross the border of the United States and Mexico, connecting the sea with the Gulf of California. The system would incorporate a series of locks that would allow the exchange of water between the sea and the Gulf. Various federal, international and Mexican agencies would be involved in planning and approving this alternative.

The diversion of saline water into the Gulf of California would necessarily involve an accord between United States and Mexico. This would take the form of either a "minute" to the existing 1945 treaty or a new treaty, implicating the International Boundary and Water commission, and domestically would involve the Department of State, the Department of Interior and the EPA. The Colorado River Board, Salinity Forum, Colorado River Basin State, Bureau of Reclamation, CVWD, IID, SWRCB, RWQCB and EPA would be among the principal players.

III. Institutional and Legal Considerations

Some parts of the legal and institutional context arise from generally applicable environmental, natural resource and civil law rather than from responsibilities or authorities granted to a specific agency. This section provides an overview of such laws including those relating to land ownership, Salton Sea waters, CEQA and NEPA, civil litigation concerning flooding, and laws relating to Colorado River apportionment.

A. Land Ownership

Any works constructed an the Salton Sea bad or on adjacent lands would, of course, require either approval of the landowner or exercise of any available condemnation authority. Most of the lands in the Salton Sea area are public federal lands, and fall into one or more of the following four primary reservations. In 1924 and 1928, the President of the United States executed Public Water Reserve Order No. 90 and 114 for withdrawal of lands located in and surrounding the Salton Sea. The Public Water Reserve consists of 123,360 acres of public land lying below an elevation of 220 feet. These lands were designated as a repository to receive and store agricultural, surface, and subsurface drainage waters.

The Bureau of Land Management (BLM) has withdrawn or acquired an additional 111,170 acres below elevation 220 feet and most of those areas are included in the Public Water Reserve. BLM also has withdrawn lands above 220 feet which were acquired for potential agricultural development or for specific purposes such

an rights-of-way. Public Law 728 of the 81st Congress (1950), authorized the Secretary of the Interior to purchase all Indian lands in the area below 220 feet to be held as part of the drainage reserve (but no acquisition has yet occurred). The Imperial Irrigation District (IID) purchased lands of the Southern Pacific Company below 230 feet.

The Salton Sea National Wildlife Refuge once consisted of 32,407 acres along the Sea shore, but all of this land has since been flooded by rising water levels. The Federal government continues to manage a portion of the remaining shoreline which it leases from IID. The U.S. Navy is another major land holder in the area. The Navy operates the Salton Sea Base and has air and surface rights over a large portion of the Sea. The total area of the military reservation encompasses approximately 80 square miles and includes military withdrawal lands, other federal agency withdrawal lands, Navy owned lands, other federally owned lands, and leased lands.

The Torres Martinez Indian Reservation, located in the northwest area of the Sea, encloses about 25,000 acres of Indian Trust lands, more than 18 sections (or portions of sections) of which have been submerged by the Sea.

The State of California, Imperial and Riverside counties, the Imperial Irrigation District and private owners constitute the other land owners in the area. Some state school land sections may underlay the Sea. As noted in other sections of this report, the Imperial Irrigation District has acquired, in fee title or through flooding easements, most of the privately hold lands below 220 feet.

B. Salton Sea Waters

At the turn of the century, the Salton Sea was a dry lake bad. Around 1904, farm drainage waters from surrounding areas began to be directed to the Sea. In 1905 and 1906, flooding from the Colorado and Gila Rivers caused the creation of a large lake in the sea bed. The water level in the sea rose to 195 feet above sea level. After the flooding ceased, the water level began to decline until 1925. At that time, the water level again began to increase due to natural and irrigation return flows. The New and Alamo Rivers constitute the primary natural inflow to the Sea.

Regulation of the Salton Sea by the federal and state agencies discussed in this report will often be dependent upon whether the body of water constituting the Sea is within the class of waters over which the particular agency has been granted jurisdiction. The surface of the Salton Sea and adjacent wetlands are subject to state and federal jurisdiction with regard to pollution control. Any pollution issues involving the Sea bed and land surrounding the Sea would be covered primarily by State regulation.

State agencies, such as the State Water Resources Control Board and the Regional Water Quality Control Board, have generally been given authority over the "waters of the state". This term encompasses any water, surface or underground and specifically including saline waters, which is located with the State, within the boundaries of the state or where applicable, a particular region of the State.

The United States Bureau of Reclamation has jurisdiction generally over the waters involved in projects created under the Bureau's auspices. Other federal agencies, such as the Environmental Protection Agency and the Army Corps of Engineers, have been given authority over the "navigable waters" of the United States. This term has traditionally been broadly defined by the Courts to include waters that are, were, or could be made to be navigable. In 1972, the Federal Clean Water Act (CWA) expanded this definition to the limits of the commerce clause of the United States Constitution. The CWA states that the term navigable waters means waters of the United States, including territorial seas. Neither the traditional nor expanded federal definition reaches groundwaters.

C. The California Environmental Quality Act and the Permit Review Process

The California Environmental Quality Act (CEQA), mandates the environmental review of all projects that could have a significant impact on the environment. If CEQA applies, it may impose a number of legal

constraints which may limit the scope of the project. For example, CEQA requires that public agencies consider the possible environmental effects of the proposed project, any alternatives to the project, and feasible measures to mitigate the potentially adverse environmental effects of the project.

If the proposal under consideration is a project and is not subject to either a statutory or categorical exemption, the lead agency will generally conduct an Initial Study Survey to determine whether the project has the potential to result in significant impacts on the environment. In complying with this requirement, the agency may use a similar analysis that was prepared pursuant to the National Environmental Policy Act (NEPA).

If, after conducting an Initial Study, the agency determines that "there is substantial evidence that any aspect of the project, either individually or cumulatively, may cause a significant effect on the environment, regardless of whether the overall effect of the project is adverse or beneficial, the agency shall" prepare an EIR (CEQA Guidelines Section 15063).

The National Environmental Policy Act (NEPA) applies to projects subject to the discretionary approval of federal agencies or projects that will be conducted by federal public agencies. The alternative selected for implementation in the Salton Sea may require the approval or participation of federal agencies. For instance, if the insea impoundment option is chosen, a dredge and fill permit must be obtained from the Army Corps of Engineers, both to conduct the actual dredging and to discharge the dredged material. If the project may affect the human environment, an Environmental Impact Statement must be prepared in compliance with NEPA. Both CEQA and NEPA contain provisions permitting the joint preparation of an environmental impact analysis.

The requirements of NEPA and CEQA are very similar. The principal distinction in that NEPA has been interpreted by the courts to be a procedural statutory requirement. The Act mandates that agencies study and consider the environmental effects of proposed actions, but does not specifically restrict the scope of permissible agency action if the EIS identifies a significant, unmitigated or unmitigable adverse environmental impact.

By contrast, CEQA contains specific directives concerning the appropriate actions to be taken by an agency in the face of a finding of a significant adverse environmental impact. The CEQA Guidelines state that no agency may approve or carry out a project if the EIR identified a significant impact that would result from the project unless the agency makes one of three findings. The agency must find that either the project has been altered so as to mitigate the impact, or the necessary changes are within the jurisdiction of another agency and could or should be adopted by that agency, or specific economic, social, or other considerations make unfeasible the mitigation measures of the project alternatives identified in the EIR (Guidelines Section 15091). The latter finding is commonly referred to as a Statement of Overriding Considerations.

CEQA provides Responsible and Trustee Agencies an opportunity to comment on the environmental document prepared by the Lead Agency. Trustee agencies are state agencies having jurisdiction by law over natural resources affected by the project. Both Fish and Game and the State Lands commission are considered trustee agencies, Guidelines Section 15386. Upon completion of the draft EIR or the Negative Declaration, Responsible Agencies may reach their own conclusions on whether and how to approve the project, but they must consider the environmental effects of the project as shown by the EIR when reaching their decisions (Guidelines Section 15096).

The Lead Agency has the power to impose all measures necessary to mitigate significant environmental effects involved in the project provided the agency is otherwise given discretionary authority over the project,, Guidelines Section 15040-15042. Unlike Lead Agencies, Responsible Agencies may disapprove or condition a project only to avoid direct or indirect environmental effects of that part of the project which it is called on to carry out or approved Guidelines Section 13041(b). Where a project is one of several similar projects, as may be the case with the proposed incremental development of the solar energy facility, the lead agency is required to examine the cumulative effect the entire project will have.

In summary, for an agency to approve a project, CEQA requires the lead agency to find either that there are measures to mitigate the significant environmental effects or that there are overriding economic or social factors making mitigation measures or alternatives impractical. CEQA will at least set the agenda for agency consideration of the project, though it may not dictate the result. And, though courts will defer to the Judgment of the lead agency, that agency must make a written finding concerning the disposition of significant environmental effects and have some rational basis for such findings. The effect of these requirements is likely to be to generally constrain the design of the project to reduce environmental impacts though probably not to prohibit the construction of any particular project altogether. Whether or not a Responsible or a Lead Agency in legally required to adhere to mitigation measures and alternatives raised in an EIR, EIR/ZIS or Negative Declaration, CEQA and NEPA often raise issues and considerations that would not have been considered absent the CEQA/NEPA process.

D. Litigation

In response to a complaint from a flooded landowner, the Department of Water Resources investigated the use of water by the Imperial Irrigation District, concluding in a December 1981 report that water was being wasted. The Department referred the matter to the State Water Resources Control Board which conducted hearings and in, June of 1984 found in Water Rights Decision 1600 that excess irrigation return flow resulted from unreasonable water use in the District. The Board noted that the District contributed about 70 percent of the inflow to the Salton Sea and that the water level would likely stabilize and the salinity would increase from a reduction of inflow (e.g., 100,000 acre-feet of year) associated with water conservation. In reaching its decision, the Board noted that:

"It is impossible to predict when the salinity will adversely affect the fishery either with or without a planned reduction in IID inflow. However, the rapid rise in salinity between 1980 and 1982 shows that salinity could exceed 40,000 ppa, the danger level for fish reproduction, in less than five years whether or not a planned reduction in inflow takes place. Therefore, it is apparent that a prolonged delay in water conservation measures would not save the fishery for an appreciable length of time." Water Rights Decision 1600 page 61

The Board ordered the District to develop, implement and monitor various elements of a conservation plan, involving controls in tailwater, canal spills, canal seepage and leaching, as well as the construction of regulatory reservoirs. The District unsuccessfully contented the Board's authority in court. Compliance with the Board's order has not yet been achieved and is currently at issue.

Landowners flooded by the rising waters of the Salton Sea (i.e., in excess of 3 feet since 1974) have previously sued the Imperial Irrigation District in several suits. (Elmore v. Imperial Irrigation District, 159 Cal. App. 3d 185 (1984); Salton Bay Marina. Inc. v. Imperial Irrigation

District, 172 Cal. App. 3d 914 (1985), and Anderson v. Imperial Irrigation District and a Valley Water District, Imperial County Superior Court No. 57249). To date, the decisions have gone against the District, finding it negligent and liable for damages for the flooding, notwithstanding written flood easements and agreements.

E. Law of the River

The "law of the river" in a collection of state, federal and international laws and court decisions which have evolved during this century. Together, these authorities define the water rights of the Federal government,, basin states, the holders of Colorado River water rights within those states, and the Republic of Mexico. Among the major local authorities are the 1922 Colorado River Compact, 1928 Boulder Canyon Project Act, several Arizona v. California U.S. Supreme Court decisions, water contracts signed by the Secretary of the Interior, the 1945 U.S.-Mexican Water Treaty and the 1974 Colorado River Basin Salinity Control Act. Facets of the "law of the rivet" remain uninterpreted and uncertain.

Basically, the useful flow of the Colorado River system has been divided first between the United States and

Mexico, secondly between the upper and lower parts of the basin in the U.S., thirdly, among the states of that basin, and finally, primarily among the holders of rights within those states. California users have an entitlement to 4.4 million acre-feet per year (plus possible surplus) which in allotted generally and approximately as follows: Palo Verde Irrigation District (220,000 APY), Imperial Irrigation District (2,600,000 APY), Yuma Project (38,000 APY), Indian Reservation (134,000 APY), Coachella Valley County Water District (1,200,000 APY) and Metropolitan Water District (up to 1,100,000 APY).

Various features of the Salton Sea management options could intersect with the law of the river. Any diversion and use of Colorado River water (e.g., wet year surges) for direct dilution of salinity in the Salton Sea, for example, could raise questions as to debiting of water right entitlements, definitions of surplus and beneficial use, power proceeds and Mexican treaty obligations. The discharging of Salton Sea water into Mexico could bring questions about the scope and meaning of the U.S. commitment to Mexico concerning water delivery and salinity control.

F. Possible Additional Sources of Regulations

The scope of this study was necessarily limited by both time and informational constraints. Therefore, a decision was made to restrict analysis of the many agencies and entities that could become involved in the solution of the Salton Sea dilemma to certain agencies of central interest and to exclude those from analysis those agencies that appeared likely to play only a peripheral role in the implementation of any of the four alternatives addressed. The specific rationale for excluding several of those agencies from study is discussed below.

As indicated in Section IV-B.l.b., the Torres-Martinez Indian Reservation encompasses 25,000 acres of land which is either adjacent to or submerged by the Salton Sea. Indian land ownership can give rise to more complicated issues than arise in other land ownership situations. The primary distinction arises from the fact that Tribes are sovereign entities and may exercise a considerable amount of control over actions taken on Tribal reservations.

The extent to which the relationship between the governmental authority of the Torres-Martinez tribe and the authority of the State of California will become an issue in the implementation of any of the Salton Sea alternatives cannot be determined at this stage. Resolution of the complex questions that could arise will be dependent upon specific facts concerning the details of the alternative implemented. As currently described, none of the alternatives appear to directly involve the governmental authority of the tribe. For these reasons, an analysis of tribal involvement in the implementation of an alternative has not been conducted. To the extent possible, however, areas in which issues might arise have been identified.

The Pump out/Evaporation/Solar Ponding alternative contemplates the production of electricity. Power production could invoke the Jurisdiction of the Federal Energy Regulatory Commission (PERC), Department of Energy (DOE), the State Public Utilities Commission (PUC) and the California Energy Commission (CEC) The primary area of PERC regulation would center upon the certification of the plant as a small Power Producer. The involvement of the PUC is dependent in part upon whether the solar facility will be constructed by a state or private entity. Since this information is not currently known, the PUC has not been analyzed. DOE involvement is similarly uncertain, but might arise if DOE were to issue a grant for the construction of the project as a demonstration project. The CEC would only become involved if the plant were to be capable of producing in excess of 50 megawatts, which in not currently contemplated.

An emission of pollutants to the air would be likely to invoke the regulatory authority of the State Air Resources Board and the appropriate Air Pollution Control District. There is currently no available information which describes the nature and extent of such emissions.

Implementation of the Gulf Waterway alternative would obviously necessitate the cooperation of the Mexican Government and its agencies. To the extent possible, the international aspects of this alternative have been

addressed in this study. However, a discussion of direct Mexican governmental and agency involvement in permitting the project is beyond the scope of this analysis.

IV. Agency Reviews - Salton Sea Alternatives

A. International Boundary and Water Commission

This section contains a survey of the principal international, federal, interstate, state and local government institutions as they may affect, or be affected by, the principal Salton Sea management options.

The International Boundary and Water Commission (IBWC) is an international body composed of representatives of the United States and Mexico. The Commission is generally responsible for dealing with issues related to the U.S. Mexico boundary, particularly those related to water resource problems. The powers and duties of the Commission pertain, for the most part, to overseeing the application of the 1944 Treaty between the United States and Mexico (15 Stat.1219). The Treaty was negotiated to establish Mexico's right to use waters of the Colorado River System, the Tijuana River and the Rio Grande River.

Under the Treaty, Mexico is guaranteed a minimum quantity of 1.5 maf/yr of Colorado River water from any and all sources according to schedules agreed to by the two countries. Provisions were made for construction of diversion and flood control structures on each side of the border. The issue of water quality was not addressed expressly, but was covered in 1973 by Minute 242 to the Treaty. The Commission is authorized to settle all differences that arise as a result of the "interpretation or application of the Treaty" and to ensure the implementation of Minute 242.

The Commission is organized with the U.S. and Mexico each having a Section. Members of each Section, including an Engineer commissioner, two engineers, a legal adviser, and a secretary, are designated by the respective Government, and are entitled diplomatic status. The Sections are directly responsible to the State Department (in the case of the United States) and the Ministry of Foreign Relations (in the case of Mexico). The physical jurisdictional boundaries of the IBWC extend to the border reaches of the Rio Grande and Colorado Rivers, the land area between the two countries and works located on the common boundary.

Relevant to the proposed alternatives, the Commission has powers and duties to: investigate and plan works to be constructed which deal with the international boundary or international waters; construct such works or supervise their construction; execute and prevent violation of treaties and agreements, utilizing the jurisdiction of courts or other agencies an necessary; discuss and negotiate settlements to disputes between the two Governments; furnish information to the two Governments; construct, operates and maintain stream gauging stations within the boundary area; submit annual reports to the Governments on matters related to these duties.

Whenever the construction or use of works related to an agreement under the jurisdiction of the IBWC takes place wholly within one country or the other, then federal agencies of that country may be authorized to operate and maintain such works in accordance with all international obligations.

The IBWC has no authority in the area of planning and policy making. The recommendations of IBWC are developed on an issue-specific basis, and reflect the negotiated positions of the United States and Mexican governments.

Under the No Action alternative and the other project alternatives, pollution from the New and Alamo Rivers will continue to flow into the Salton Sea. Resulting closures of parts of the Sea, recreational facilities, and/or measures by State or local agencies to treat or regulate pollution levels would involve both the United States and Mexico. Negotiations under this type of circumstance might would be carried out under the auspices of the IBWC.

The in-sea impoundment and pump out/evaporation/solar generation options would involve construction and

operation of facilities completely within the jurisdiction of the United States, and would involve waters controlled by and stored in the United States. The IBWC probably would not be involved under these options as described.

Under the Gulf Waterway alternative, construction and operation of the waterway system would impact water and land resources within the United States and Mexico and along their common border. According to the provisions of the 1944 Treaty between the United States and Mexico, the IBWC has the duties and powers to investigate, plan, construct, operate and maintain works dealing with boundaries and international waters, and each Section has jurisdiction over works constructed within its respective national territory. A new accord, such as a new treaty or a new "minute" to the 1944 Treaty, could be negotiated to provide for the amount of water to be exchanged between the Salton Sea and the Gulf, the financing, construction, operation and monitoring of the project, and other features.

This option could potentially affect U.S.- Mexico Treaty relations in several ways. It is possible that the water diverted from the sea could be utilized in some manner in Mexico, depending on the quality and quantity of water available. Existing international water delivery facilities, notably the by-pass canal at the Yuma desalination plant, could be utilized under this scenario. Because the operation of this existing facility in governed by Treaty conditions, IBWC would become involved. The international boundary issues that might arise under this option can only be evaluated after the proposed action is described in more detail.

B. National - Federal

1. Department of the Interior

a. Bureau of Reclamation

The mission of the United States Bureau of Reclamation (USBR) to reclaim arid and semi-arid lands in western states was born with the 1902 Reclamation Act. The Bureau plans, designs, constructs, operates and maintains water storage, hydropower and diversion projects. Originally, the goal of the reclamation laws was to rehabilitate farms on the lands targeted for Bureau projects and to provide opportunities for permanent settlement and agricultural development on irrigable desert land (16 U.S.C. sections 590 et seq.). The agricultural development of the Imperial and Coachella Valleys, formerly desert areas, was achieved by irrigation works planned and constructed by the Bureau of Reclamation pursuant to its statutory mandate.

Projects constructed by the Bureau include the Boulder Canyon Project (authorized effectively in 1929) under which the Hoover Dam, as well as the Imperial Dam and All-American Canal which serve the Imperial and Coachella Valleys, were constructed. The United States retains title to the project works but the operation and maintenance of the Imperial Dam, the All-American Canal and the remaining distribution systems within the Imperial Valley have been assumed by the Imperial Irrigation District (IID).

The United States owns the 72 million gallon per day desalting plant which is being erected in Yuma, as well as the temporary bypass facilities which presently divert the highly saline drainage waters from the Welton-Mohawk District around the Mexican diversion point below the border. In addition the Bureau administers the Colorado River water delivery contracts and governs the release of stored water from Lake Mead for the diversions through the All-American Canal to the Imperial Irrigation District and the Coachella Valley County Water District.

Jurisdictional ownership and claims of the Bureau of Reclamation over the waters of the Salton Sea, which might give rise to a local duty to act, are unclear. The USBR may be subject to the laws of the state of California relating to the control, appropriation, use or distribution of water within the boundaries of the state for or from the Bureau projects used in irrigation. The Federal Clean Water Act contains a waiver of sovereign immunity as to any federal entity engaged in an activity that could result in a run-off of pollutants. Congress demonstrated its recognition of the potential for harm to the environment caused by irrigation return flows by

requiring the Bureau to conduct investigations of soil characteristics that might result in toxic or hazardous return flows when seeking to utilize dams or reservoirs built by the Corps of Engineers.

Thus, the Bureau may have some responsibility for pollution and salinity problem associated with agricultural drainage waters in instances in which the Bureau is a discharger. The recent actions taken in response to the selenium problems at the Kesterson Wildlife Refuge are an example of this type of USBR responsibility. At Kesterson, irrigation drainage systems constructed and maintained by the Bureau had discharged agricultural waste containing high levels of selenium into the Refuge waters. The water discharged had accumulated selenium as it passed through the irrigated soils. A farmer whose land was adjacent to the Refuge complained to the Regional Water Quality Control Board (RWQCB) that the Bureaus practices threatened the farmer s land. The RWQCB failed to act and the farmer appealed to the State Water Resources Control Board. The State Board found that the Bureau had violated state water quality laws by causing a condition of pollution and nuisance. The Bureau was ultimately forced to cease discharge and initiate a closure plan that would include a method by which to clean-up the polluted Refuge.

The situation in the Salton Sea differs from Kesterson in one important aspect. The Bureau itself does not discharge waters to the Salton Sea. Traditionally, the Bureau has disclaimed responsibility "at the headgate" -- at the point where a district takes water from a Bureau canal. Apart from local responsibility, the Bureau's expertise in the area of water management and its involvement in Colorado River water delivery to IID and the Coachella Water District make it a candidate for the role of organizing a Federal action to address the Salton Sea dilemma, or of acting as a valuable consultant on state sponsored actions. The rising incidence of pollution problems associated with irrigation drainage water in its projects has already increased the interest and level of involvement of the Bureau in return flow management issues. This interest was doubtlessly stimulated in part by the Reclamation Reform Act, which established for the Bureau a policy of rehabilitating and improving existing reclamation projects, such as those around the Salton Sea, for purposes of significant conservation of the environment, water resources, water quality and energy. The Bureau is already undertaking projects to reduce Colorado River salinity under the Colorado River Basin Salinity Control act of 1977. Thus, both Bureau expertise and policy may prompt its involvement in the selection and implementation of any of the Salton Sea solutions.

b. Bureau of Indian Affairs

The Secretary of the Interior is trustee of the approximately 25,000 acres of Indian trust lands which make up the Torres-Martinez Indian Reservation. The Bureau of Indian Affairs within the Department of the Interior is the agency responsible for administering the trust relationship. As of 1968, some 18 sections of trust land were wholly or partially flooded by the Salton Sea. A 1950 Act authorized the Secretary of the Interior to purchase the-Indian lands below the -220 foot contour line (at a maximum price of $5,000); however, no purchases were made under that Act. Litigation brought against the imperial irrigation District and the Coachella Valley Irrigation District by the U.S. Department of Justice on behalf of the Torres-Martinez Indian Tribe for flooding damage is currently pending.

Any of the alternatives,, and particularly the no action alternative, would find the Bureau of Indian Affairs concerned about the level and quality of the water as those factors would bear on the use and value of the Indian lands,, and the recreational importance of the Sea to the Indians. Unless the pump out evaporation pond were located adjacent to the Northwestern part of the Sea where the Indian trust lands are situated, none of the three action alternatives would appear to have a greater impact than another as to the Torres-Martinez Reservation.

c. Fish & Wildlife Service

The responsibilities of the U.S. Fish and Wildlife Service (FWS) include administration of the National Wildlife Refuge System and enforcement of the provisions of the various Migratory Bird Treaties to which the United States is a party. FWS additionally administers any lands acquired by Federal construction agencies for the purposes of wildlife conservation. The Service also has the authority to cooperate with states and their

respective Fish and Game Departments in fish restoration and management projects, including the restoration of water or land which is adaptable as fisheries.

The FWS, pursuant to Congressional declarations recognizing the importance of the preservation and development of fisheries, as well an the inherent right of U.S. citizens to engage in fishing, has statutory duties related to these areas. Included among those duties are the development and recommendation of measures appropriate to assure the maximum sustainable production of fish; the development, advancement, management, conservation and protection of fish and wildlife resources by research and development of existing facilities and the acquisition or exchange of land and water for fish and wildlife conservation purposes. FWS is likely to be involved in all the Salton Sea alternatives, due to the presence of the Salton Sea National Wildlife Refuge it administers along the southern shore of the Sea.

FWS is authorized, pursuant to the Migratory Bird Treaty Act, to enforce certain provisions of the Migratory Bird Treaties, and must administer lands acquired or reserved for the preservation and protection of migratory birds in accordance with obligations arising from United States treaties made with Canada, Mexico, Japan and the USSR. Federal law enacted pursuant to those obligations makes it unlawful to kill by any means whatsoever any migratory bird in any stage of development except in special situations governed by regulations promulgated by the Secretary of the Interior. Penalties for violations include fines and imprisonment.

FWS is also authorized to make investigations at the direction of the Department of Interior (DOI) to determine the effects of polluting substances on wildlife. The investigations must include the determination of standards of water quality for the maintenance of wildlife, and the study of methods of abating and preventing pollution.

The Salton Sea National Wildlife Refuge originally consisted of some 32,407 acres of land bordering the Sea. Since 1930, the original refuge has become inundated by rising Sea waters. However, the FWS continues to manage 2,560 acres leased from the Imperial Irrigation District (IID) and a private landowner as a National Wildlife Refuge and as part of its waterfowl management program. Any disturbance of National Wildlife Refuge land is strictly prohibited. The Secretary of the DOI, however, has the authority to permit the use of any area within a Refuge for any purpose compatible with the use of the area as a refuge. Where such permission is granted, the permittee must render compensation for the land used to the Department, either in fair market purchase or rental value, or by exchange of equally suitable land. The FWS is responsible for the enforcement of these provisions.

The "no action" alternative challenges the Fish and Wildlife Service's responsibility to administer the Salton Sea National Wildlife Refuge in accordance with the Migratory Bird Treaty Act and other statutorily imposed duties. Since the refuge in situated along the southeastern shore, it in directly exposed to the inflows from the New and Alamo Rivers. FWS responsibilities concerning the protection and conservation of fish and wildlife resources, and its duty to recommend measures to sustain the Salton Sea's fishery could be affected. Additionally, the Service could be called upon by the Secretary to study methods of preventing or abating the pollution. Should concentrations of pollutants in refuge waters reach levels that prove fatal to migratory waterfowl, FWS responsibility for the enforcement of treaties and laws prohibiting the unlawful killing of migratory birds could be activated. Such a situation arose at the Kesterson Wildlife Reservoir (see discussion in Section IV.B.l.a.). Selenium deposits carried to the reservoir by a United States Bureau of Reclamation drainage system were responsible for the death of migratory birds. The Department of the Interior (DOI) ordered delivery of water to the irrigated areas stopped and drains emptying into the reservoir plugged. In ensuing this order, DOI cited violations of the Migratory Bird Treaty Act relating to the protection of migratory birds. DOI later relaxed its position and allowed delivery of water to proceed, but enforced the order that drains of the reservoir be plugged.

Much of the construction of the massive dike proposed by the "in-sea evaporation" alternative will be on, or in close proximity to, submerged and unsubmerged refuge lands administered by the FWS. Impacts of the construction on the refuge must be considered, and consultation with the FWS will, of course, be required. Exchange of lands may also be required to compensate for those submerged refuge lands used for the dike and

impoundment.

Each of the three action oriented alternatives will invoke the comment and review authority of the FWS if a federal permit must be acquired. Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted or otherwise modified or controlled for any reason, by any Federal agency or public or private agency under a Federal permit or license, the proponent must consult with FWS with a view to the conservation of wildlife resources. Project proponents must submit the recommendations of the Service to the agency that will approve or authorize the project.

2. Department of Defense, Army Corps of Engineers

The Corps of Engineers (COE) is authorized to construct, operate and maintain congressionally approved water resource development projects, and to cooperate with state agencies in the preparation of comprehensive plans for the development, utilization and conservation of water related state resources. It has the further authority to acquire, in the name of the United States, title to all lands, easements and rights-of-way needed for flood control or dam projects. Federal investigations of rivers and other waterways for the purposes of flood control are also within the supervisory jurisdiction of the COE, although this grant of authority may not interfere with United States Bureau of Reclamation jurisdiction.

The Corps may become involved in the Salton Sea under all of the alternatives under the general statutory authorities discussed above. In addition, the Secretary of the Army has been given the responsibility for the investigation and study of the feasibility of utilizing the capabilities of the Corps of Engineers to conserve fish and wildlife and their habitats. The first report prepared pursuant to this duty is due to be issued no later than May 1989, and biennially thereafter.

If the in-sea evaporation and impoundment alternative is selected, the project would require COE approval. The Corps has approval authority over plans for the construction of any bridge, dam, dike or causeway over or in any navigable waters of the United States. Under Section 10 of the Rivers and Harbors Act of 1899, the project proponent would also be required to obtain a dredging permit from the Corps prior to commencing the considerable dredging activities contemplated by this proposal. A permit would also be required under section 404 of the Clean Water Act for discharge of dredged spoil.

The pump out/evaporation/solar generation alternative would not appear to directly involve the permitting authority of the COE unless work is required to be undertaken on the Salton Sea bed. The Corps will almost certainly be involved in the planning and construction of a navigable waterway from the Sea to the Gulf of California under the Gulf Waterway alternative. The COE can reasonably be expected to participate in the planning and implementation of this alternative not only as a consequence of its jurisdiction over navigable waters, but because of the necessary federal involvement in a project of international scope, and the Corps expertise in the planning and development of facilities for water navigation.

3. Environmental Protection Agency

The Environmental Protection Agency (EPA) is responsible for water quality standards under the federal Clean Water Act (CWA). In practice, this entails the review and approval of water quality standards (designated uses- and water quality criteria) adopted by the State Water Resources Control Board (SWRCB). The SWRCS has designated the following beneficial uses for the Salton Sea: warm water habitat, wildlife habitat, water contact recreation, and non-contact recreation. It is noteworthy that drainwater retention is not a designated beneficial use.

The primary means of meeting the standards adopted pursuant to the Clean Water Act is the issuance of National Pollutant Discharge Elimination System (NPDES) permits. Any person seeking to discharge waste from a point source to navigable waters must obtain an NPDES permit. The definition of a point source is broad and was initially interpreted to include irrigation return flows. However, extensive amendments to the CWA

adopted in 1977 specifically excluded agricultural return flows from the definition of a point source. As a result such discharges are regulated as nonpoint sources and are exempt from NPDES permit requirements.

Nonpoint sources are loosely regulated under the CWA. The Act directed State Water Quality Management Plans to be developed and submitted to the EPA for review and approval. The plans were required to address a broad range of topics, including, where appropriate, the identification of problematic agricultural nonpoint sources and procedures to control such sources. The impact of this and other CWA provisions is to require the use of best management practices by agricultural dischargers.

Recent amendments to the CWA have focused attention on nonpoint source issues by requiring states to compile an assessment report identifying water sources experiencing water quality problems caused by nonpoint sources and setting forth best management practices governing nonpoint source discharges to such waters.

The CWA and EPA regulations implementing the Act direct states to identify water bodies for which effluent limitations and beat management practices are insufficiently stringent to ensure that applicable water quality standards are achieved. Such water bodies are termed Water Quality Limited Segments (WQLS). For each WQLS identified, the state is required to determine the total maximum daily load (TXDL) of pollutants that can be discharged to the water body without preventing the attainment and maintenance of water quality standards. The permissible level of discharge to a WQLS is calculated by determining the loading capacity of the WQLS, which is defined as the amount of material that the water body can accept without violating applicable water quality standards. Load allocations and waste load allocations are then determined. A load allocation is that portion of the receiving waters loading capacity that is attributable to an existing or future nonpoint source discharge or to natural background sources. Waste load allocations are the portion of the receiving waters loading capacity that is allocated to an existing or future point source discharger. The load allocation and the waste load allocation, when added together, comprise the total maximum daily load (TMDL) which may be discharged to the receiving waters. The Salton Sea has been classified as a WQLS. The WQLS findings, the load allocations, the waste load allocations, and the TMDL level must be periodically submitted to EPA for its approval.

EPA has approved TMDLs and waste load allocations submitted to it by California. California has not calculated load allocations or submitted such allocations to EPA for its approval. In Scott vs. UA, slip opinion, nos. 81-2884 and 81-2885, U.S. App. Ct. 7th Cir. (1954). the court held that EPA must treat an unexcused and lengthy delay in the submittal of TMDLs as a constructive decision by the state that TMDLs were not required, and subject the decision to EPA's review process. Load allocations are regulated in the same manner as TMDLs. Therefore, Scott vs. EPA provides support for the proposition that an unexcused failure to submit load allocations must be reviewed by EPA as a decision not to issue load allocations. If EPA disapproves of the decision, it must promulgate load allocations for the state.

The "no action alternative" would likely see a worsening of the quality of the waters in the Salton Sea that would be attributable in part to continued nonpoint source discharge of irrigation return flows. This would challenge the EPA to consider the revocation of its approval of the Salton Sea TMDLs. EPA may also intercede if neither the state nor regional water boards institute a plan to regulate the load allocation of nonpoint sources (See Section IV.D.2.a. and b.).

EPA has oversight authority over dredge and fill permits issued by the Army Corp of Engineers. EPA may therefore become involved in those aspects of the in-Sea impoundment alternative that entail diking, since dredge and fill permits would be required. The pump out/ evaporation/solar generation option, by withdrawing receiving waters, could alter the impact of the pollution loading and raise EPA concerns. The transportation of polluted drain waters under either this alternative or the Gulf Waterway option may become subject to EPA approval.

C. Interstate

1. Colorado River Basin Salinity Control Forum

The Colorado River Basin Salinity Control Forum was established by the seven states of the Colorado River Basin to conduct periodic water quality reviews of the river pursuant to the requirements of Section 303 of the Clean Water Act of 1977. Basically, it reviews existing state adopted and EPA approved numeric standards for salinity control of the Colorado River System, evaluates changes in hydrologic conditions and water use within the Basin, and recommends revisions to implementation plans for salinity control.

The Forum's 1984 report recommended no changes in the EPA salinity standards for the three lower main stem stations on the Colorado, namely Hooker Dan, 723 mg/l; Parker Dam, 747 mg/1; and Imperial Dam, 879 mg/l. Actual counts were reported as below these standards at, respectively, 682, 703, and 732 mg/l.

While the Forum has no direct regulatory or programmatic/management authority with respect to the Salton Sea and the alternative solutions proposed, it does formulate and recommend implementation plans for salinity control in the Basin, some of which may be relevant to the Sea's increasing salinity. In its 1984 report, for example, the Forum recommended implementation by the Department of Agriculture of cost effective salinity control measures for on-farm irrigation and lateral distribution systems; it also recommended implementation of its policy of increased use for use of brackish and/or saline waters for industrial use.

However, many of the control measures described have already been implemented in the Imperial and Coachella Valleys. Moreover, since the Forum's primary concern is control of salinity in the Colorado River, drainage of saline irrigation waters into the Salton Sea and away from the River is viewed as beneficial.

The Forum would become involved, and in an strictly advisory capacity, if one of the alternatives posed a threat of increased salinity in the Colorado River. As none of the alternatives contemplate such an impact, the Forum's only other involvement might be in an advisory capacity arising from its expertise in salinity control in the Basin.

D. State

1. Resources Agency

a. Department of Fish and Game

The Department of Fish and Game's (DFG) general responsibility is to ensure that fish and wildlife are preserved. The Department's programs are directed towards the protection, conservation, enhancement and restoration of fish and wildlife resources and habitats. DFG's future fish and wildlife resources and habitats. DFG's future involvement with the Salton Sea is most likely to arise from the exercise of its authority in three areas. First, enforcement of the provisions and regulations of the Fish & Game Code; second, the management and protection of inland fisheries; and finally, the review of Federal, State, local and private projects affecting the water or water quality of the state, in order to minimize any potential adverse impacts on fish and wildlife which might be caused by the project.

DFG and Fish & Game Commission policy regarding the Salton Sea is set forth in miscellaneous Addenda to the fish and Game code. This policy is to:

> "Recognize that the Salton Sea has been designated a a repository for agriculture drainage water (Federal Public water Reserve Number 90 and Number 114). The commission also finds that the Salton Sea has unique and valuable fish and wildlife resources and associated recreational values, and the Commission and the Department shall be guided by the following objectives:
>
> I. Preserve the biological integrity of the Salton Sea and its associated wetlands habitats.

II. Protect and perpetuate the diverse fish and wildlife resources of the Salton Sea ecosystem for the use and enjoyment of present and future generations.

III. Prevent or allevaite those aspects of projects, developments and activities which would or do exert adverse impact on the habitats and fish and wildlife resources os the Salton Sea ecosystems.

IV. Urge the formation of a multi-agency task force with instruction to prepare a program designed to permanently stabilize Salton Sea salinity and water elevation at levels which will sustain and perpetuate existing fish and wildlife resources concomitant with energy development and releated projects."

If the no action alternative is pursued, the DFG may become involved through enforcement actions against persons who have permitted harmful substances to pass into the waters of the state. The Fish and Game Code makes it "unlawful to deposit in, permit to pass into, or place where it can pass into the waters of the state" an enumerated list of pollutants and any "substance or material deleterious to fish, plant life or bird life." Violation of this section is a public offense subject to criminal prosecution. The DFG may enforce this code section regardless of whether the violator is meeting Waste Discharge Requirements established by the appropriate Regional Water Quality Control Board (RWQCB). When the department finds a violation, it must first report to the appropriate RWQCB. DFG then acts through and in cooperation with the Regional Board to obtain correction or abatement. The department may act independently without the express approval of the Regional Board where the pollution affects fish and wildlife resources. General policies of the state with respect to the preservation and enhancement of wildlife resources and habitat and to the Salton Sea itself statutorily compel DFG to take action where fish and wildlife are clearly threatened.

Dischargers of substances deleterious to fish and wildlife are also civilly liable to DFG for actual damage and costs of cleanup,, and for the unlawful or negligent destruction of fish and game. The State Water Resources Control Board (SWRCB) must be notified of, and has the right to join in, any such action if the activities causing the destruction involve the unlawful discharge of pollutants or other violation of the Water Code.

The Department will also be involved in the Salton Sea under all of the three "action" alternatives. The extent of DFG involvement will be dependent upon the degree to which the particular project will impact on fish and wildlife. If, as would seem likely, the projects would have a beneficial impact on fish and wildlife, the Department would probably support implementation of the selected alternative. If the alternative also poses the risk of a negative impact, DFG would work with the project proponent to alter the project to alleviate the risk completely, or at least mitigate the risk to an acceptable level. The plans for each of the projects would have to be submitted to DFG for its review. The construction of the project may not commence until the department has found that the project will not substantially adversely affect an existing fish or wildlife resource. DFG has similar authority over projects that alter the beds of lakes and streams. This aspect of DFG jurisdiction could also be triggered by any of the three action alternatives.

The in-sea impoundment option, requiring the construction of an extensive dike enclosing a portion of the sea, would trigger DFG's review and approval authority since the project proposes changing the bed of a lake. This option will require both maintenance dredging at the mouths of the New and Alamo Rivers and possible dredging of the Sea floor to construct the dike. Use of vacuum or suction dredge equipment for any of the work triggers the DFG's permitting authority. Finally, construction of the dike probably triggers the department's power to order that the free passage of fish out of the impoundment be provided for in the plan.

DPG has the power to order the owner of any conduit with a maximum flow capacity over 250 cubic feet per second to install screens on the conduit to prevent fish from passing into it, and to order persons constructing dams to provide for the free passage of fish over or around the dams. Conduits diverting less than 250 cfs are also governed by the Fish and Game Code. The DFG's authority to order installation of fish screen could be triggered under the "pump out evaporation" alternative in the event the rate of pump out were to exceed 250 cfs through a given conduit. The Department's authority to order the construction of fishways may be implicated by

the Gulf Waterway option, as could its approval authority over projects that use vacuum or suction dredge equipment.

b. Department of Parks and Recreation

The role of the Department of Parks and Recreation (DPR) in Salton Sea Management revolves around its responsibility to develop, manage and preserve the natural and environmental resources of the Salton Sea State Recreation Area that stretches along the eastern shore of the Sea.

Continuing flooding of the littoral lands within the state recreation area boundaries under the "no action" alternative may inhibit DPR's ability to preserve and maintain park lands. Increasing salinity and pollution, by imperiling fish and wildlife and deterring recreational use of the waters, similarly conflicts with the DPR's duty to preserve and protect natural resources on park lands for recreational and environmental purposes.

The DPR has authority to grant permits for rights-of way across state parks for roads, water pipelines and power lines. If the proposed pumping station under the "pump out evaporation" alternative were situated such that park lands separated it from the site of the solar powerplant, application to the DPR for a permit or easement for the water pipeline, and perhaps for transmission lines to supply the pumps with power, would be necessary. The DPR's permission would also be needed to obtain a right-of-way for an access road to the pumping station across state park land, if no reasonable alternative route is available.

c. Department of Water Resources

The Department of Water Resources (DWR) is responsible for the protection, conservation, development, and management of California's water resources. Its major management responsibilities involve investigating, planning and recommending to the Legislature methods of supplying water for domestic, agricultural industrial and recreational use, as well as for power generation and fish and wildlife. DWR also has responsibilities in the areas of flood control and the approval and regulation of the construction and maintenance of dams.

DWR has direct jurisdiction over all dams and reservoirs in the State. No dam or reservoir may be constructed, maintained or operated without the approval of the department.

DWR's dam approval authority is activated by the proposed construction of a barrier for impounding water which is: (l) 25 feet or more in height from the base of the outer limit of the barrier or (2) which impounds more than 50 acre-feet of water, but is not (3) a levee on the bed of a natural lake built for the purpose of flood control or (4) across a natural drainage area with the primary purpose of impounding water for agriculture use or sewage sludge drying. Once a state water or dam project has been authorized or funded, the department has the power to condemn real property for state water or dam purposes, with California Water Commission concurrence as required by necessity and the public interest. Property already dedicated to public use in not to be condemned under this provision except for a "more necessary" use than that which is ongoing; nonetheless, the department may acquire by eminent domain or otherwise property dedicated to park purposes when such property is necessary for state water and dam purposes.

DWR has broad investigative powers, as well as planning and reporting duties regarding all matters pertaining to the water resources of the state, including a duty to investigate and report on water quality. The department may undertake investigative activities on its own initiative or at the request of a city, county, state agency or public district. If no action is taken to correct the problems currently being experienced in the Salton Sea, or if further research is required prior to the selection of a solution, DWR may become involved in the study of Salton Sea problems and solutions. DWR's expertise may also contribute to the planning and implementation of any of the three action alternatives.

Increasing salinity and pollution in the Sea under the "no action" alternative would come within the scope of DWR's investigative and reporting duties regarding water quality. DWR's jurisdiction has already been

triggered by the waste of water by the Imperial irrigation District (IID). Continued flooding will involve the Department's responsibilities to determine flood damage and prepare plans and recommendations for flood control development projects. DWR's flood control responsibilities include making recommendations, preparing plans, and estimating the costs and benefits of all proposed water conservation and flood control projects, with due consideration given to fish and wildlife values. The director has the power to declare an emergency in the event of floods, and to direct the Department to perform any work required to avert or repair damage.

DWR's expertise in the areas of flood control and water projects is likely to result in DWR involvement in the impoundment and Gulf Waterway options. If the situation in the Sea is not found to be an emergency, the Department has no authority to undertake the construction of flood control or other water projects without the formal request of a city, county, state agency or public district that would be obligated for the costs of construction thereby. Plans and recommendations formulated by DWR must be submitted to the Legislature, and are advisory in nature. DWR also has the duty to plan recreational development associated with state constructed water projects.

d. California Water Commission

The California Water Commission (CWC) is a consulting commission within the Department of Water Resources (DWR). CWC confers with, advises, and makes recommendations to the director of the DWR, and has the duty to report annually to the department and the legislature on the progress of construction and operation of the State Water Resources Development System.

The State Water Resources Development System is comprised of state water facilities and such additional facilities as have been or may be authorized by the Legislature as part of the Central Valley Project or the California Water Plan. Among those state public works specifically identified as elements of the State Water Resources Development System are the Oroville Dam (on the Feather River); the California, North Bay and South Bay aqueducts and their appurtenant facilities; levees, control structures, and their appurtenant facilities in the Sacramento-San Joaquin delta for water conservation, flood and salinity control; and facilities for the removal of drainage water from the San Joaquin Valley. The remedial alternatives proposed for the Salton Sea, as major public water development works, could be funded pursuant to the Water Resources Development Bond Act, and become a component of the State Water Resources Development System, subject to annual review by the CWC.

The Commission also has the duty to represent the state before the appropriations committees of various federal agencies, and to consult with interested local, state and federal agencies prior to engaging in such representation. Further, the CWC has the duty to advise DWR and the governor as to matters concerning the coordination of planning, construction and operation of federal water development and flood control projects in the state.

The CWC will be involved in all of the remedial alternatives, to the extent that these alternatives also involve the DWR and the federal government.

e. Colorado River Board of California

The Colorado River Board of California is comprised of both public members and members representing agencies with Colorado River water and power rights, including the Palo Verde Irrigation District, the Imperial Irrigation District, Coachella Valley Water District, Metropolitan Water District of Southern California, and the Department of Water and Power of Los Angeles. The Colorado River Board of California is a state agency created by the Legislature in 1937 following the passage of the Boulder Canyon Project Act of 1928 and the California Seven Party Agreement of 1931, which allocated California's allotment of Colorado River water among the major water agencies of Southern California. (See Section III. C of this report on the Law of the River).

The primary function of the Board in to protect the rights and interests of the state, its agencies, and its citizens in the water resources of the Colorado River System. The Boulder Canyon Project Act (45 Stat. 1057) authorizes state commissions to serve in an advisory capacity to the Secretary of the Interior and the board fulfills that function for the State of California. While the Board does not have direct authority over the management of the Salton Sea, its staff and members are actively involved in review and consultation on a range of issues related to Colorado River water management.

The statutory duties of the Board generally are to: safeguard and protect the rights and interests of the state, its agencies and citizens in matters regarding Colorado River System water; investigate past, present and potential uses of Colorado River water within and without the state; investigate claims of all state, public, and private agencies regarding use of the water; negotiate with representatives of other states, the United States government and others regarding the development of the Colorado River Basin, the use of water, protection of interests, and to make recommendations to the Governor and legislature.

The state agencies represented on the California -Colorado River Board depend almost entirely on the River for their water supplies. Through the Board these agencies maintain an active involvement in issues related to Colorado River operations, water supply and conservation, storage and flood control operations, power contracts, and water quality. The Board has been particularly active as a member of the Colorado River Basin Salinity Control Forum, a basinwide organization which plans and monitors salinity control programs in the basin.

The inflows to the Salton sea are comprised primarily of irrigation drainage water return flows from Colorado River water used in the Mexicali, Coachella and Imperial Valleys. Therefore, any substantial changes in the use, availability and distribution or quality of water due to management of the Salton Sea can trigger the Board's participation.

In recent years, the Board has actively taken part in water conservation and salinity control issues affecting the Imperial and Coachella Valleys. The Board's staff has worked on studies to identify water conservation opportunities, such as lining the All-American Canal, directed toward maximizing California's beneficial use of water. The recent negotiations between the Imperial Irrigation District (IID) and Metropolitan Water District (MWD) over entitlement to water conserved through irrigation system improvements within IID demonstrate the potential for involvement of, and conflict within, the Board over issues related to management of the Salton Sea.

Under the "no action alternative" anticipated gradual changes in water and salinity levels will probably trigger the Board's involvement in an advisory capacity. Several of the agencies represented on the Board have substantial authority related to the project alternatives.

Following the recent mandates by the State Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB), IID is developing measures to conserve Colorado River water used for irrigation purposes. Members of the Board are in disagreement over the transfer and use of the conserved water. Inflows to the Sea can be expected to decrease significantly once conservation measures are approved and implemented.

It is difficult to determine the Board's specific position on the in-sea evaporation and pump out/ desalination/solar generation project alternatives until the proposed actions have been closely defined, and the lead agency is identified. Evaporation and/or removal of water from the Sea might be construed as a change in use of the water, but only if storage of the drainage waters is itself recognized as a beneficial use of Colorado River water. It seems unlikely that evaporation or removal of water from the Sea would fall under the areas in which the Board has statutory authority.

If the proposed pump out/desalination/solar generation option involves the direct diversion of agricultural return flows prior to discharge into the Sea, the issue of water rights might be raised by agency representatives on the Board. Specifically, while the potential remains for conservation of agricultural water, agencies might object to

the "dedication" if return flows to the evaporation operation, preferring instead that additional measures for water savings be undertaken before disposing of the water through evaporation.

Under the Gulf Waterway option, the Board might become involved in studies or negotiations regarding implications for the use, distribution, allocation and quality of waters of the Colorado River system. Existing institutional arrangements for the allocation and management of Colorado River water, known collectively as the "Law of the River" might be affected by the implementation of this option.

For example, the diversion of saline water to the Gulf also might become physically or institutionally linked to existing salinity control and water delivery agreements between the United States and Mexico. The water pumped out of the Salton Sea might be deemed "surplus" within the meaning of the Law of the River. Under the California Limitation Act of 1929 (Stat. 1929, c. 16,p.38) California is entitled to 4.4 maf/yr of the approximately 7.5 maf/yr apportioned to the Lower Basin under the Colorado Compact, plus not more than one-half of any excess unapportioned waters. Thus, Lower Basin users could be impacted if the waterway's operation utilized "surplus" waters which might otherwise be available. Finally, construction of the waterway would necessarily involve an accord between the United States and Mexico. The Board, under its statutory authority to protect the water rights and interests of the State and its citizens, would be a participant in any discussions and arrangements related to the accord.

2. Environmental secretary

a. State Water Resources Control Board

The Primary responsibility of the State Water Resources Control Board (SWRCB) is to develop plans to preserve and enhance the quality of the state's water, and to oversee the proper allocation and effective utilization of CaliforniaÕs water resources. The State Board has broad investigative powers necessary for the implementation of its duties. The SWRCB may conduct investigations of all streams, lakes, stream systems and all other bodies of water; hold hearings and take testimony regarding water rights or water use; and determine the legality of proposed appropriation of water. The Board has exclusive authority over the appropriation of water, reviews all applications for permits, and or revoke permits and licenses for appropriation of water.

The State Board has the duty to formulate and adopt state policy for water quality control and is responsible for the control of pollution and nuisance; it is also the state water control agency responsible for administering the provisions of the Federal Clean Water Act. The Board has the power to require local and state agencies to investigate and report on water quality control techniques, and may review the actions of the Regional Water Quality Control Boards (RWQCB). If a RWQCB fails to take required action, the State Board may exercise the Regional Board's powers.

The State Board also has a duty to administer the water policies declared in Article 10, section 2 of the State Constitution. This section requires that the water resources of the state be put to beneficial use to the fullest extent possible, and that the waste and unreasonable use of water be prevented.

The Environmental Protection Agency (EPA) section of this report explained and discussed the State's duty to submit Total Maximum Daily Loads (TMDLs) and load allocations for Water Quality Limited Segments (TMDLs) such as the Salton Sea. Although TMDL and waste load allocation have been submitted to and approved by EPA, load allocations have not been determined or submitted for any of California's WQLSs, including the Salton Sea. If no steps are taken by the Water Board to calculate and submit load allocations, EPA could treat California's failure to act as a constructive determination that no load allocations will be set. In such a case, EPA would have to either approve or disapprove California's constructive decision if EPA disapproves the decision, it must promulgate such load allocations as it deems necessary (see Section IV.B.1.3).

The "no action" alternative would continue to activate the State Board's duties to see that the waters of the Sea are put to beneficial use to the fullest extent possible. Continued use of the Sea as an irrigation return flow

repository, and the associated adverse water quality impacts, could preclude use of the Sea for the recreational beneficial uses designated in the Regional Water Quality Control Plan (see section 11.3.b). In such a situation, use of the Sea as a repository could conceivably be construed as a violation of the State Board's responsibilities under the State Constitution.

Applicable statutes and regulations are unclear an the question of whether the impounding of Salton Sea waters entirely within the Seas existing shores under the "in-sea evaporation" alternative would constitute an appropriation of water such that the State Boards regulatory authority over appropriations would be triggered. Since the dike impounding the waters is to be constructed entirely on the bed of the Sea and within its present shores, there may be no "taking" of water from the Sea. However, the act of drawing water into the impoundment may constitute a diversion and could therefore be regulated in an appropriation. Analysis of the Board's authority, if an appropriation were established, would be the same under this alternative as for the pump out/evaporation alternative, discussed below.

The SWRCB's regulatory authority over appropriation of water could be triggered by the Salton Sea alternatives that propose conveying water out of the Salton Sea. An appropriation is any taking of water for other than riparian or overlying uses. T he primary permit requirement is that the water appropriated be applied to a beneficial use. Recreation, power production, and preservation and enhancement of fish and wildlife resources are all deemed beneficial uses. The applicant for an appropriation must also establish that the requested water is unappropriated.

Much of the water that originally formed the Sea and that currently flows into the Sea is water that was previously appropriated by the Imperial and Coachella irrigation Districts for agricultural use. These waters may revert to unappropriated status once the appropriators have permitted the waters to drain into the basin and have ceased to apply the drainage waters to any beneficial use. Notice to the prior permittee and a hearing before the Board upon request are now required by the Water Code before previously appropriated water can be declared unappropriated.

Pumping out of the Seas waters for evaporation would constitute a taking of "surface waters" of the state for other than riparian or overlying use, and thereby would trigger the State Boards regulatory authority over appropriations. Similarly, waters pumped or drained out of the Sea and into a canal or locks for discharge into the Gulf under the Gulf Waterway option would probably constitute an appropriation and invoke the State Board's regulatory authority.

b. Regional Water Quality Control Boards

The Salton Sea is located within the jurisdiction of the Colorado River Basin Regional Water Quality Control Board. The Regional Water Quality Control Boards (RWQCB) have the power to adopt water quality control plans for their respective regions. State offices, departments and boards, when carrying out activities which may affect water quality, must comply with the Water Quality Control Plans (WQCP) adopted by the RWQCB.

The WQCP must establish water quality objectives which will ensure the reasonable protection of beneficial uses and prevent nuisance. In order to determine the appropriate objectives, therefore, the Regional Boards must also designate the beneficial uses of particular water bodies. Beneficial uses to be considered in setting objectives include past, present and probable future uses. Beneficial uses are defined under the California Porter-Cologne Water Quality Control Act to include uses of the water itself. For example, a beneficial use of water would be to supply irrigation water or to provide an aquatic habitat. A water repository is not a beneficial use since it is the use of an area of land rather than the use of the water that collects on the land.

The beneficial uses for the Salton Sea identified by the Water Quality Control Plan adopted by the Colorado Regional Board in 1984 include the recreational use of the Sea for boating, fishing, swimming, warm water habitat and a saline habitat. The Plan also establishes the following water quality objectives for the Sea:

"The total dissolved solids concentration of the Salton Sea as of May 1983 is approx 38,900 mg/l.

In order to protect all beneficial uses of the Sea, the water quality objective is to limit the rate of increase of total dissolved solids of the Salton Sea to the lowest possible value, consistent with its primary purpose as a reservoir to receive agricultural drainage and seepage and storm waters. It is recognized, however, that this objective could become increasingly difficult as various water conservation measures are implemented." Water Quality Control Plan, Colorado River Basin Regional Water Quality Board,, Chapter 4,, section I.B.

Identification of the "primary purpose" of the Sea as a drainage reservoir is made in reliance on the Federal Government's withdrawal of all public lands in the Salton Sea area for the creation of a Public Water Reserve in 1924.

One of the central mechanisms by which the regional boards may seek to achieve water quality objectives is through the issuance of Waste Discharge Requirements (WDR). The board is also responsible for the issuance of dredged and fill material permits.

Any entity seeking to discharge waste in a manner that could affect the waters of the state must obtain WDRs from the regional board. WDRs contain conditions designed to achieve water quality objectives and protect beneficial uses. The requirement that WDRs be obtained may be waived by the board if to do so would not be contrary to the public interest. WDRs are routinely waived for agricultural discharges.

As discussed in the Environmental Protection Agency (EPA) section of this report, the Salton Sea has been identified as a Water Quality Limited Segment (WQLS) and a total maximum daily load (TMDL) has been calculated, as required by the Federal Clean Water Act and EPA regulations implementing the Act (see Section IV.B.3.) EPA also requires identification of load allocations and wasteload allocations for WQLSs. Load allocations are defined as that portion of a water bodies loading capacity (the maximum amount of matter that the water body can receive without violating water quality standards) that is attributed to an existing, future, or natural nonpoint source discharger. Wasteload allocations are that portion of the water bodies loading capacity that is attributed to an existing or future point source of pollution. EPA requires TMDLs, wasteload allocations, and load allocations to be set at levels necessary to attain and maintain applicable water quality standards.

The Colorado River Basin Regional Board has not identified a load allocation for nonpoint source discharges to the Salton Sea. Under the no action alternative, continued failure to comply with the EPA requirement that such allocations be made could result in either federal or state action to compel compliance or set load allocations, or a citizen suit demanding compliance with the CWA and EPA regulations. As discussed in the section on EPA, the EPA must approve or disapprove load allocations within 30 days of the submission of allocations by the state. In Scott vs. EPA, slip opinion Nos. 81-2884 and 81-2885, U.S. App. Ct. 7th circuit (1984), the court hold that the failure to submit TMDLs could constitute a constructive submission of no TMDLs, requiring EPA approval or disapproval of this state decision that no such levels are necessary. Characterization as a constructive submission is dependent upon whether the state can justify the failure to act (see Section IV.B.3).

The Regional Board would be directly involved in permitting the in-sea impoundment alternative by virtue of the Board's authority to issue dredged material discharge permits. This alternative proposes discharge of the dredged material in such a manner as to create island and wetlands

for an expanded wildlife habitat. Discharge may not be permitted, however, if the dredged material is so contaminated by exposure to the Sea waters that such discharge would be harmful to fish and wildlife. Disposal of the excess briny waters created under the pump out/solar power plant option may likewise require issuance of Waste Discharge Requirements by the Board.

The State and Regional Boards also have an established policy of cooperating with other agencies towards the resolution of water quality problems that require actions outside the basic jurisdiction provided by the Water Code. This policy would encompass actions taken to protect the recreational and environmental beneficial uses

of the Sea. Therefore, the State and Regional Boards could be participants in the planning of each of the alternatives.

3. Department of Health Services

The Department of Health Services' (DHS) responsibilities with respect to Salton Sea management are limited to its general duty to promote an environment that will contribute to human health and well being through its toxic substances control and environmental health program The Department has the duty to establish by regulation minimum standards for the sanitation of public beaches, a term encompassing many beach used by the public for recreational purposes, owned, operated or controlled by the state, any state agency, any local agency, or any private person in this state. Violations of sanitation regulations applying to public beaches include the presence, at any time, of visible "sewage, sludge, grease or physical evidence of sewage discharge" on the beach or in water contact sports areas. In the event of a violation, the DHS may, at its discretion, post warning signs, restrict the use of, or even close, the beach or water contact sports area until such time as the standards are met.

DHS is empowered to order any detected contamination of water abated and to bring suit to enjoin further contamination. Contamination in this context is defined as impairment of water quality by waste to a decree which creates a hazard to public health through poisoning or the spread of disease; "waste" is sewage and all other waste substances "associated with human habitation, or of human or animal origin, or from any producing, manufacturing or processing operation of whatever nature." Upon discovery of a pollution or nuisance, the Department has the duty to report the condition to the appropriate Regional Water Quality Control Board (RWQCB), and to investigate such conditions when so requested by the board.

DNS has no specific management duties with respect to the Salton Sea, other than those relative to its regulatory authority over contamination and public beaches. However, the Department does have a general statutory directive to protect the public health, and to prevent the discharge of sewage and "other waste" in any manner resulting in contamination, pollution or nuisance.

Warnings have already been posted in some shore areas of the Salton Sea. Under the "no action" alternative, continuing inflows of untreated sewage from the New and Alamo Rivers into the Sea could well result in further and more extensive violations of sanitation standards for public beaches and water contact sports, resulting in additional DHS action such as the posting of warnings of closure of beach areas to the public. If DRS were to detect a contamination of the Salton Sea waters and was also able to determine the source of the contamination, the Department could issue an abatement order. If pollution or nuisance is shown to exist, the Departments role would be restricted to reporting the condition to the RWQCB and performing investigative measures requested by the Board. DRS would have no direct involvement in any of the other alternatives.

4. Solid Waste Management Board

The Solid Waste Management Board (SWMB) has the primary responsibility for formulating and adopting the state's policy for solid waste management. The Solid Waste Policy must take into consideration the recommendations of the State Water Resources Control Board (SWRCB) regarding the prevention of water pollution and the minimum public health standards established by relevant provisions of the Health and Safety Code. The Board has the duty to conduct studies and investigations regarding new or improved methods of solid waste management, and to act as a clearinghouse or solid waste management information. It has the power to promulgate regulations to carry out the policies it formulates, and to organize, operate and conduct solid waste enforcement activity at the request of local governing bodies.

The Board has approval authority over solid waste management plans prepared by the counties pursuant to Government Code provisions. Once such plans are approved by the Board, all state offices, departments and boards must comply with them in carrying out any activities involving solid waste disposal and the Board has the power to require such compliance.

The Solid Waste Management Act in enforced on a local level by Local Enforcement Agencies (LEA's). Any person or entity seeking to construct a Solid Waste Facility must first obtain a permit issued by the LEA and concurred in by the State Board. The term Solid Waste Facility encompasses facilities whose function is to store waste, facilitate the transfer of waste, or accept waste for disposal. The definition of waste includes solid, semi-solid and liquid wastes. In reviewing a permit application, the LEA's primary concerns are ensuring that the proposed facility is capable of meeting the State Solid Waste Standards and is consistent with both the County Solid Waste Management Plan (CoSWMP) and the applicable General Plan for the area in which the site will be located. (The General Plan is a land use planning document adopted by local government agencies, which specifies the permissible uses of property.) A facility may be found to be consistent with the CoSWMP only if it in consistent with the applicable General Plan. To be consistent with the General Plan, the facility must be located in an area designated or authorized for use an a Solid Waste Facility site. Amendment of a CoSWMP requires the approval of a majority of the cities located within the county.

It is unclear whether the impoundment structure to be constructed under the impoundment option should be classified as a solid waste facility subject to the jurisdiction of the Board. The definition of solid waste is very broad and could be interpreted to encompass the residual salts to be housed in the impoundment. The plan to leave the salts in the impoundment for up to one hundred (100) years may constitute "disposal." If the impoundment is not within the definition of a disposal facility, it could still be viewed as a storage facility. The ramification of inclusion within the class of facilities governed by the Solid Waste Management Act is that the site upon which the structure will be constructed must be consistent with the applicable General Plan and County Solid Waste Management Plan. Since it is unlikely that the Sea has been designated for the siting of a solid waste facility, an amendment to the CoSWMP, concurred in by a majority of the cities in the county must be obtained before construction of the impoundment may commence.

The SWMB, and the Imperial County solid waste enforcement agency, may become involved in the in-sea evaporation alternative, due to that options proposed use of the impoundment area an a repository for the salts removed from the Sea. A permit from the county, approved by the Board, could be required before the process of concentrating salts in the impoundment began.

5. California State Legislature

The California State Legislature stands in a unique position with respect to the problems facing the Salton Sea, and to the proposed alternatives for addressing those problems. It may, by enacting legislation, expand the statutory powers and duties of the various state agencies involved and thereby empower them to act where no action is presently permitted by the existing scope of the agencies authority. A number of state Constitutional provisions, such as Article 10, section 2 (declaring that the general welfare requires that the water resources of the state be put to beneficial uses to the fullest extent possible), amount to directives guiding, and to some extent, compelling legislative action aimed at resolving the Seas longstanding problems.

Recently proposed or enacted legislation specifically targeting the Salton Sea provides clear examples of the foregoing. Section 1013 of the Water Code, added in 1987, relieves the IID of civil liability for any damages in and around the Sea arising from implementation of water conservation measures.

Proposed, but not enacted in 1987, was Assembly Bill 930, an act to add a new chapter to the Water Code relating to financing a program of wastewater and toxic cleanup of the international border region of California. The bill specifically refers to the problem of the flow of polluted New River waters into the Salton Sea, and proposes researching, planning and constructing facilities necessary to mitigate, reduce or reverse the effects of pollution and contamination in the international border area.

Senate Bill 34 amended, repealed and added certain sections to the Water Code providing authority and funding for the building of levees in the Sacramento River delta, and for the creation of a special fund for the mitigation of adverse effects to water quality, fisheries and wildlife in the Delta and in the Salton Sea and its tributaries.

The texts or each of these legislative acts, whether simply proposed or actually enacted into law, clearly illustrate the State Legislatures awareness of the Salton Sea's salinity, pollution and flooding problem, as well as its unique ability to take measures intended to resolve those problems.

6. Office of the Attorney General

The Attorney General (AG) is the chief law officer of the state, and has the duty to see that the laws of the state are uniformly and adequately enforced. The AG has supervisory authority over all District Attorneys and sheriffs in the state,, and may bring any action that may be brought by a District Attorney (DA). Generally, the AG is in charge of all legal matters in which the state has an interest.

The Attorney General's office represents a number of State agencies concerning their affairs, including the California Energy Commission (CEC). The AG represents the interests of the State in water rights actions; represents the State Solid Waste Management Board in litigation concerning its affairs; and enforces solid waste management plans formulated by county solid waste management boards. In addition, the AG's office may bring an action on its own motion, or at the request of the Director of the Department of Health Services, to enjoin violations of hazardous waste control laws and seek civil and criminal penalties for their violation.

'The Attorney General's Office has specific duties and responsibilities relevant to the problems of salinity and pollution facing the Salton Sea. It has the statutorily imposed duty to enforce the State's policy of preventing the destruction, pollution or irreparable impairment of the environment and natural resources of the state. The AG can intervene in any judicial or administrative proceeding in which facts are alleged concerning pollution or adverse environmental effects which could affect the public generally, or in any proceeding for judicial review upon a showing the matter under review involves issues which may have an adverse effect upon the environment. Furthermore, the AG may bring actions for equitable relief such as injunctions, against any person for the protection of the State's natural resources from pollution, impairment or destruction.

From the foregoing,, it in clear that the AG may become involved in some manner in each of the alternatives considered. Because the "no action" alternative contemplates progressively deteriorating environmental conditions in the Salton Sea and its tributaries, the Attorney General's duty to enforce the State's policy of preventing the destruction, pollution of or irreparable harm to the environment is seriously challenged. Should concentrations of pollutants in the waters flowing into the Sea reach levels violative of hazardous waste control laws, the AG may be compelled to act as well. The AG may also have the duty to exercise its power to intervene in administrative and judicial proceedings that raise environmental issues concerning the Salton Sea.

With respect to the remedial alternatives, the AG's involvement would be limited to its representation of the various agencies concerned in the development of each option. However, it may be required to intervene on behalf of a state agency involved in administrative or judicial proceedings initiated in order to implement one of the options, as an adjunct to its general duty to protect the environment.

E. Local Government/Special District

1. Imperial County

Most of the Salton Sea lies in the northwest corner of Imperial County, and within the service area of the Imperial Irrigation District (IID). The County of Imperial has a broad range of responsibilities over all types of land use and development activities within its boundaries. It has local government authority over all unincorporated areas in the county and cooperates with other planning agencies in planning for incorporated cities, and State and Federal lands. Most of the lands surrounding the Sea in Imperial County are within the Public Water Reserve. Federal, State and local agencies are involved in the management of public lands within their domain. The County cooperates with these agencies in planning and management on unincorporated lands. The County's objectives and policies for growth and resource development are set forth in the Imperial County General Plan (1973).

The Plan serves as a guide in the provision and administration of public services, in determining land use, and in evaluating development proposals. All cities and counties are required to prepare and adopt a comprehensive, long-term general plan containing the following elements: land use, circulation, housing, conservation, open space, seismic safety, noise, scenic highways, safety. Each element includes a statement of County objectives, policies, standards and programs for that area. In meeting its planning objectives, the County relies primarily on police powers such as zoning ordinances, use designations and restrictions, and permitting authority.

The elements of the General Plan that pertain to the proposed project address land use, open space and conservation elements. The County adopted an Ultimate Land Use Plan an a basis for the preparation and adoption of land use plans for individual planning units or areas. The County's overall land use policy focuses on the preservation and development of agricultural land as the economic mainstay for the County. The County relies on zoning designations as the primary means of guiding development of the unincorporated areas of the county.

The Open Space Element of the County's General Plan pertains to the preservation of natural resources, the managed production of resources, outdoor recreation, and the protection of health and safety. Lands designated for agriculture, low density residential, recreation, preservation and special public may be managed an open space. Most of the land surrounding the Salton Sea falls within these designated uses. (Salton Sea Beach and Bombay Beach are recognized as urban areas which are expected to grow.) The Plan specifies open space areas to be protected including critical habitat and wildlife areas under Federal, state and local jurisdiction. Among these, the Salton Sea National Wildlife Refuge (Federal), the Imperial Wildlife Management Areas (State) are located near or adjacent to the Sea. Adverse impacts to these waterfowl habitat areas would trigger County involvement pursuant to the open space management objectives.

The Open Space Element also recognizes the importance of managing agricultural, mineral and geothermal resources for production. Prime agricultural land is to be preserved wherever possible and geothermal and other resource development are encouraged in open space areas. Outdoor recreation provides an important source of economic growth for the County. Open Space policies and programs are designed to protect natural values and recreational opportunities on Federal, State and County recreational lands by restricting land uses that generally detract from these values (e.g., utility corridors, irrigation systems). Finally, the public health and safety policies for Open Space lands restrict uses in areas prone to natural hazards or that are unsuitable for development. For example, floodplain and waterway zoning restricts development near the New and Alamo Rivers or in floodplain areas near the Sea.

The Conservation Element of the General Plan applies to all unincorporated land within the County, regardless of designation. This Element sets forth County policies and programs for managing all natural resources. The Water Resource and Biological Resource sections of the Conservation Element are the most relevant to plans for Salton Sea management. The Water Resources section identifies primary water-related issues in the County, including: the decreasing quality of Colorado River water used in irrigation; impacts of waste waters from Mexicali; increasing salinity in the New and Alamo Rivers and the Salton Sea; flooding potential; federal and interstate water allocation agreements; impacts of flood control on wildlife and vegetation. The section on Biological Resources identifies these areas of significant statewide concern and their corresponding habitat values. The Salton Sea, the Colorado River, the New and Alamo Rivers and wetland areas are among those specified in the Plan. In general, the County's authority with regard to these resources consists of assisting in the review of all development plans and proposals.

Under the no action alternative, County involvement could be triggered through changes in the water surface levels, due to declining inflows, and/or changes in water quality as they affect resource use and development in the County. The County seeks to protect and preserve wildlife and recreational resources, and would support efforts by State and regional regulatory agencies (e.g., Water Quality Control Boards, Department of Fish and Game, County Health Department) to minimize water quality impacts.

Changes in water levels also could trigger the land management authority of the County. The County operates

two marinas and manages waterfowl refuges on the southern shore of the Salton Sea. The gradual reduction in "freshwater" inflows to the Sea in expected to decrease the water surface level. The County could implement zoning measures in shoreline areas to restrict development of any drained lands. The County also might become involved in planning and restoring flooded wildlife areas and recreational areas as the Sea level drops.

County involvement under the "in-sea evaporation" option primarily would consist of reviewing project plans and environmental assessments, and requiring mitigation measures deemed necessary to ensure compliance with County policies for land use and resource conservation. The County has police power over land use, and would require a land use permit for construction activities (i.e., staging areas, etc.) or project facilities on County managed lands. The County could restrict such uses so as to limit impacts to wildlife and recreational resources. A Special Public lands designation might be applied given the specific use of the diked area. Under this proposed alternative, water and salinity levels are expected to decrease in the "preserved" area of the Sea. The County might restrict development of shoreline lands in light of recent flood damage claims. The expected decrease in salinity levels might be offset by reduced "freshwater" inflows to the Sea. In this case, County involvement would mitigate impacts to recreation and wildlife resources in the area.

The concentration of salts in the impoundment area might lead to impacts in the area of solid waste disposal. The County would require measures necessary to minimize these effects in compliance with solid waste management standards. Over the long-term, improvements in the conditions of the Salton Sea could enhance recreation and tourism development in the County, resulting in increased demands for services in these areas, and increased revenues to the County.

The development of an evaporation site on undeveloped land under the pump out/desalination/solar generation option would require a land use permit and perhaps a Special Public Lands designation by the County. Project development would be restricted to limit the impacts on sensitive and protected resources and public safety. A comprehensive environmental assessment in compliance with the California Environmental Quality Act regulations would be required for the pumping/ evaporation project and any subsequent project phases (i.e., 25 XW solar power plant). The County would review and provide comments on these assessments in light of policies for land use, air quality, health and safety, waste disposal, utility access.

Salinity levels in the Sea would decrease under this option. However, pollution levels and diffusion might worsen depending on the rate and location of pumping, and the overall change in the surface area of the Sea. In the area of water, the County would require compliance with State standards. As discussed above, a decline in the Sea surface level could trigger County land use authority.

The construction and operation of a 25 MW power plant generally would be consistent with County policies for managed production of resources (in the Open Space Element). Reclaimed water and/or electric power produced by the project might be used to support local development. The County would exercise review authority over project plans in cooperation with the California Energy commission and other responsible agencies.

The Gulf Waterway option primarily would fall under the jurisdiction of Federal and State level agencies. The County would participate in project assessments and reviews, but would have direct authority only over activities affecting unincorporated lands within its jurisdiction. As in the options discussed above, the County would exercise government and police powers over land use, and would require compliance with all applicable standards for health and safety, environmental protection, public services and utilities.

The exchange of water between the Salton Sea and the Gulf, with possible resultant changes in the Sea water level and in salinity levels could also trigger County involvement in areas of floodplain management, water quality, recreation and wildlife. Briefly, a change in water levels could result in floodplain zoning or land use restrictions for affected areas along the shore to protect against flood damage and/or to conserve open space consistent with existing land use designations. Changes in water levels and water quality could have an effect on recreation and tourism in the area, or on wildlife habitat in and around the Sea. The County is likely to

participate in the protection of these resources, either directly through imposition of land use controls or indirectly through the proposal review and comment process. The County could benefit from the expenditures, and tourism and development associated with an international canal.

2. Riverside County

The County of Riverside, like Imperial County, has a broad range of responsibilities over all types of land use and development activities within its boundaries. (See discussion or Imperial County above)

Riverside County encompasses 7,310 square miles. The northwest portion of the Salton Sea, approximately one quarter of the total area of the Sea, is located within the boundaries of Riverside County. Most of the lands surrounding this portion of the Sea are unincorporated and thus fall under the general management authority of the County. The County's objectives and policies for growth and resource development are set forth in the Riverside County Comprehensive General Plan (1984; amended through December 1985). The General Plan is the primary policy directive for long-term development in the County.

The Riverside County Comprehensive General Plan provides a countywide framework for guiding local government plans and activities. It outlines the County's policies and programs in the provision and administration of public services, in determining land use, and in evaluating development proposals. The proposed Salton Sea alternatives could trigger County involvement under the following elements of the General Plan: land use, environmental hazards and resources, and public facilities and services.

The lands in Riverside County surrounding the Salton Sea are located within the Lower Coachella Valley Planning Area. The predominant land use in the area is irrigated and dry land agriculture, while a significant portion of the area is desert. The land use policy for the area emphasizes open space and conservation uses (Land Use Category-111Rural,, and IV-Outlying Areas) outside the limits of incorporated cities of Coachella and Indio. These designations generally allow low density uses such as agriculture, parks and recreation, low density residential development, and light industry and commercial uses. In addition to Comprehensive General Plan guidelines, the area also falls within the Eastern Coachella Valley sub-area. The Eastern Coachella Valley Plan identifies land use goals and policies to address concerns specific to this 201,000 acre sub-area, which includes lands surrounding the Salton Sea. This plan recognizes agriculture as the significant and continuing land use in the area, while also providing for other compatible low density uses. A special land use category was created in the Eastern Coachella Valley Plan to provide for residential and commercial development within cove areas of the Salton Sea. Industrial uses such as power plants, utilities, small dams are considered essential land uses and are generally compatible with open space and conservation designation.

Under the Environmental Hazards and Resources Element, the County has adopted policies to limit development in area prone to natural hazards (e.g., flooding, seismic activity, erosion), and has identified those areas in its Comprehensive Plan. For example, development in flood ways is restricted through floodplain management ordinances, building, land division and land use ordinances. These standards are applied by the county Planning Department in cooperation with local Flood Control Districts. In the area of Water Quality (also in this Element), the County would consider Adopting (but has not adopted) ordinances requiring water conservation plans and Best Management Practices for agricultural areas that contribute to water quality problems. Policies and programs in areas of solid waste management and energy resources also might be applicable to the proposed project.

County policies and programs in the area of parks and recreation and utilities (under the Public Facilities and Services Element) also contain provisions which apply to the proposed project. No Riverside County Regional Parks are located in the vicinity of the Salton Sea, but the County Park Advisory Commission has compiled a list of sites for acquisition as County Regional Parks. Some of these areas are located on the eastern shore of the Sea. County policy for utility planning is to encourage the use of existing corridors for the construction of transmission lines. The County has no permitting authority over utility development, but it does comment on and make recommendations to the California Public Utilities Commission (CPUC) regarding issues of

environmental hazards, public health and safety, environmental and recreational impacts, etc. The County requires a comprehensive environmental assessment of alternative facility sites and corridors.

In addition to land use compatibility under the Open Space and Conservation Element, the County has mapped areas containing important wildlife habitat, and requires mitigation of project-related impacts in accordance with the provisions of the California Environmental Quality Act (CEQA). Habitat areas for the State Endangered Desert Pupfish and the State Rare/Federal Endangered Yuma Clapper Rail have been identified in the vicinity of the Salton Sea.

Under the "no action" alternative, drainage inflovs to the Sea will decrease over time as regulatory and market pressures for water conservation increase. Rising salinity levels could adversely impact wildlife (fishery) and recreational resources in the area. In its General Plan, the county recognizes the potential impact of water quality on future economic growth (including tourism development), and has adopted a policy to encourage tourism in the county. Given the importance of the Salton Sea for recreational development, the County is likely to support any State or regional programs to control water quality impacts.

The project facilities planned under the "in-sea evaporation" option would be constructed in the southwest area of the Salton Sea, outside the jurisdictional boundaries of Riverside County. The County would be involved in reviewing and making recommendations on the project plans. In addition, County involvement could be triggered through a change in water and salinity levels. Sea water pumping into the diked area will decrease water levels and reduce salinity in the upreserved portion of the Sea. (This reduction in salinity might be offset by reduced inflows from agricultural drainage). As discussed under the No Action Alternative, water quality degradation could adversely impact fishery and recreational resources that provide economic benefits to the County.

The evaporation site proposed under the "pump out evaporation" alternative would be located on undeveloped lands near or adjacent to the Sea. Most lands surrounding the Sea in Riverside County are designated for agricultural and open space uses. Essential uses, such as power plants and small dams, are considered to be compatible with these designations though some restrictions may apply. The County would review project plans for siting, development and operation of the evaporation site to determine consistency with development objectives for the area. Policies and programs in the following areas also could apply: utilities (i.e., siting of transmission lines, public health and safety and environmental factors, design and access); solid waste disposal; wind erosion and blowsand (i.e., blowsand control plan and mitigation measures); noise (i.e., construction and operation noise measurements, and mitigation); wildlife (i.e., plan evaluation and mitigation, restricted use areas).

If a 25 MW solar energy power plant is planned under a later project phase, the County would have review and approval authority in these same areas. The energy, resources policy includes a comprehensive energy plan program to "actively seek available funding and solicit, participation in experimental development proposals involving solar energy ... ", and a corresponding land use standard to encourage use of solar energy in projects in all land use categories.

The proposed waterway under the pump out/desalination/ evaporation alternative probably would extend from an outlet on the southern shore of the Salton Sea (Imperial County) to the Gulf of California. It is expected that the proposed routing of the canal would be within the jurisdictional boundaries of Imperial County, and that all project-related facilities and construction activities would occur within that county. Riverside County would benefit from increased recreational use of the Salton Sea associated with the waterway.

The exchange of water between the Salton Sea and the Gulf might result in changes in the Sea water level (increase or decrease), and in salinity levels. These impacts could trigger county involvement in areas of floodplain management, water quality recreation and wildlife. Briefly, a change in water levels could result in floodplain zoning or land use restrictions for affected areas along the shore to protect against flood damage and/or to conserve open space consistent with existing land use designations. Changes in water levels and water

quality could have an effect on recreation and tourism in the area, or on wildlife habitat in and around the Sea. Riverside County is likely to participate in the Protection of these resources, either directly through imposition of land use controls or indirectly through the proposal review and comment process.

F. Water Districts

1. Imperial irrigation District (IID)

The general functions of the Imperial Irrigation District (IID) are to develop, preserve and conserve water for agricultural and domestic purposes within the District, and to generate, transmit and distribute electrical energy within its power service area. While the District has no direct regulatory or management authority over the Salton Sea itself, the District's responsibilities and activities related to the supply and distribution of irrigation water, and the conveyance of drainage and seepage waters, have significant impacts on water and salinity conditions in the Salton Sea.

The Imperial Irrigation District was organized pursuant to the Irrigation District Act of 1911. The District is governed by a 5 member Board of Directors, and is represented on the Colorado River Board of California. Provisions governing water supply for and diversions by the District are not forth in a number of documents, including the Colorado River Compact, the Boulder Canyon Project Act, the California Limitation Act, and the California Seven Party Agreement. In performing its responsibilities, the District has adopted and enforces it Water Department Rules and Regulations (updated 1987). The District encompasses over on a million acres surrounding the Sea in Imperial and Riverside Counties. The IID's operations currently contribute over 50 percent of the inflow to the Salton Sea.

The District operates and maintains 1,760 miles of conveyance and distribution facilities, including the Imperial Dam headworks, an 80 mile stretch of the All-American Canal, and 1,450 miles of collection drains for conveyance of agricultural return flows. Irrigation water is provided to over 600,000 acres in Imperial and Coachella Valleys, and to municipal and industrial users in Imperial Valley. In addition,, the District generates and distributes electric power for a 6,500 square mile service area in the Imperial and Coachella Valleys.

In the area of water supply and distribution, the District has the discretionary power to control, distribute, store, spread, sink, treat, purify, recapture and salvage any water for the beneficial use or uses of the district, its inhabitants, or the owners of water rights. It may construct works for the collection of water, acquire rights to store or carry water in facilities not owned by the District, and contract for the exchange, transfer or delivery of water. The District may fix rates to apportion and distribute waters among landowners, and may restrict water application in times of shortage. The District may acquire and dispose of property necessary for carrying out its purposes, and may exercise powers of eminent domain.

With regard to drainage, the recent ruling in John Elmore v. Imperial Irrigation District (205 Cal. Rptr. 433) held that the District has "a clear, mandatory duty to avoid wasting water, to prevent flooding, and to provide drainage made necessary by the operation of its irrigation system." The District has no duty to purify or treat drainage waters, although the California Department of Health Services (DRS) may give written notice to the District in special cases where water (primarily that used for domestic purposes) may be injurious to public health.

The District may but is not required to provide flood control, and may acquire the right to flood or otherwise interfere with property whether the property is publicly or privately owned. It may cooperate and enter into any contract with public agencies, state or federal governments, or private individuals as necessary to carry out its purposes.

The district has adopted a 15 point Conservation Program to improve irrigation efficiency and water conservation. The program includes rules and regulations to enhance water conservation practices by individual farmers in the District. In a 1984 ruling, Decision 1600 the State Water Resources Control Board (SWRCB)

ordered IID to develop a water conservation plan, including scheduling and financing arrangements, to use more efficiently its Colorado River water. Studies by the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation have estimated potential water savings by IID on the order of 350,000450,000 acre-feet annually through implementation of various measures including lining of the All American canal.

IID is statutorily excluded from liability for any effects to the Salton Sea caused by reductions of the flow of water thereto resulting from conservation measures (Water Code section 1013), presumably including those imposed by the SWRCB in its Decision 1600. IID is not excluded from any requirements established under California Environmental Quality Act (CEQA), however.

Under California Law, most of the District's powers are discretionary, with the notable exception of the District's mandatory duty to conserve water, prevent flooding due to its irrigation practices and provide drainage made necessary by its activities. The District may form Improvement Districts within the existing District boundaries in order to construct new or change existing water service facilities or flood and drainage control facilities.

Under the "no action" and other alternatives, IID will continue to operate and maintain its water supply and drainage facilities according to the statutory and management objectives outlined above. The District in currently involved in studies and negotiations regarding conservation improvements. The anticipated savings represent a 30 percent reduction in inflows to the Salton Sea and would effectively reduce the Sea's water level worsening the salinity and pollution concentrations in the Sea.

While the IID is not liable for damages associated with these conservation measures, neither is it relieved from the duty, arising under CEQA, to study the environmental impacts of whatever conservation mechanisms it considers implementing. Since the increase in salinity levels could be found to be a significant impact, the IID, if it in the Lead Agency, will either have to incorporate mitigation measures or adopt a Finding of Overriding Considerations. IID may consequently be involved in any of the three action alternatives that might alleviate its burdens under CEQA. The District has been involved in negotiations with other agencies for indemnification for negative impacts of increased salinity associated with water conservation efforts.

The IID's immunity from liability extends only to damage attributable to conservation measures. IID is not relieved from liability for injuries associated with past and future discharges if the extent of damage caused by discharges can be distinguished from damages resulting from conservation measures. The difficulty of separating the degree of damages resulting from the two causes may have the effect of insulating IID from any liability for salinity damages to the Sea.

IID's role in the Salton Sea may also be analogous to the role of the United States Bureau of Reclamation (USBR) in the Kesterson Wildlife Reservoir. As discussed in the section on the USBR, the Bureau was ordered by the State Water Resources Control Board to clean up pollution in the reservoir attributable to discharges of irrigation waters flowing into Kesterson from USBR drainage structures. IID could experience similar regulation, since it operates and maintains the agricultural drainage system discharging into the Sea. The Department of the Interior might also issue an order to IID to cease drainage to the Sea if migratory birds are threatened as a result of the flow of irrigation waters to the Sea. Such an order was issued by DOI against the USBR when the Bureau's drainage practices were shown to be responsible for the death of migratory birds at the reservoir.

Under the in-sea impoundment option involvement of IID could be triggered through impacts affecting land ownership, and/or a change in sea level due to construction and operation of the in-sea impoundment area. IID is a major landowner in the Salton Sea area. The District owns or has interest in lands underlying the Sea which are not otherwise held by the federal government, the Indian Reservation or a few private owners. In addition to the Public Water Reserve and Bureau of Reclamation withdrawn lands lying below 220 feet, the XID has acquired most of the privately hold lands below this elevation through fee title, or has obtained flooding rights to these lands. The District also owns and leases lands included along the shoreline of the Salton Sea National

Wildlife Refuge and the Salton Sea State Recreation Area.

The District administers engineering control over the gradient of drainage ditches and the New and Alamo Rivers and has constructed control structures to maintain the necessary gradient in these streams. Dredging activities in the "freshwater" channel and the deposition of dredged material would have to be coordinated with the District to avoid interference with this system. Finally, construction of the impoundment structure and connecting causeways might involve District owned lands on the sea bed or shore. In this case, the District Board would have the authority to lease or otherwise dispose of its property.

Under the pump out/evaporation solar ponding option, the IID could again become involved through issues of land management and ownership, as well as through its authority over the production and/or transmission of electrical energy. IID's land management and ownership interests would be similar to those discussed above.

XID's authority over energy issues includes the power to purchase or lease power from a public or private entity, construct and operate power transmission facilities, provide for the acquisition and operation of power plants and transmission facilities, and lease or sell electric power to municipalities, public entities or private interests. Under this option, the District might contract with the responsible agency for delivery of power for the pumping operations using the District's existing electric power system. Construction of the solar power plant could trigger IID involvement in areas of facility operation and maintenance, power distribution and sales.

The Gulf Waterway alternative would involve IID in much the same way as the options discussed above. Specifically, entry onto and use of District property for construction and operation of the canal and supporting facilities would trigger the Board's authority over property acquisition and disposal. Existing irrigation and drainage facilities might be impacted, necessitating relocation and engineering changes, as well as cooperation among various landowners and agencies in imperial and Riverside Counties. The District may cooperate with the federal government, state governments,, counties, public agencies and private interests for joint acquisition of property, including property in another state or nation.

2. Coachella Valley Water District

The Coachella Valley Water District (CVWD) is a public agency of the State of California, organized in 1918 under the California County Water District Act for the purposes of protecting and conserving underground water supplies for the future and present use of the Coachella Valley, and for bringing supplemental water to the Valley. Since its formation, CVWD has expanded its activities to include a range of water management services including water conservation and groundwater recharge, irrigation water delivery, domestic water production, storage and delivery, stormwater and sewage reclamation, stormwater protection and flood control. In performing these functions the District is dependent on the Salton Sea as a repository for agricultural drainage water, floodwater and domestic waste water. In addition, the District owns and operates several recreational facilities along the Salton Sea shoreline.

The CVWD encompasses a total area of over 600,,000 acres in Riverside, Imperial and San Diego Counties. Improvement District 1 of the CVWD, which is served by Colorado River water, comprises approximately 82,000 acres, of which 79,000 acres are in agricultural production. The District's water supply consists of deep well water (used for agricultural and domestic supplies) and Colorado River water. Deliveries of Colorado River water to the Valley began in 1949 with the completion of the Coachella Branch of the All-American Canal. Through contracts with the federal government, the District operates the Coachella Branch of the All-American Canal. The irrigation distribution system consists of 500 miles of supply pipelines, and nearly 200 miles of drainage pipes and open ditches for collection of drainage waters from on farm tile drainlines. Drainage waters are discharged into the Salton Sea.

In addition to irrigation supplies, the CVWD provides stormwater protection, urban water service, and wastewater reclamation service. With respect to water conservation, the District operates percolation ponds to allow delivered waters to replenish the groundwater supply. The District is affected by conditions of the Salton

Sea because most of its water management facilities are located along the shore line.

The District obtains its Colorado River water supply through contracts with the United States Department of Interior, and through an exchange agreement with the Desert Water Agency and the Metropolitan Water District. The District also has contracted with the United States for repayment of project costs for lining 48 miles of the Coachella Canal pursuant to the Colorado River Salinity Control Act (43 U.S.C. 1571 et seq.)

With regard to the management of the Salton Sea, CVWD has authority over water (including floodwater and drainage), property, sewer and wastewater facilities, recreation and power generation. The District's powers in each area are largely discretionary. In the area of water management, the District has powers to appropriate, acquire, and conserve water for any useful purpose, and may operate water rights, works and property to convoy, supply, store or make use of water for any beneficial purpose. Like an irrigation district, CVWD may establish rules and regulations for use and distribution of water, may fix rates, and may restrict water use during times of shortage. The District has powers to, but is not required to, drain and reclaim lands, and may utilize drainage and flood waters.

The Coachella Valley Water District, unlike IID, does not control lands in and around the Salton Sea. The CVWD does have the same authority to acquire property necessary to carry out its purposes. The District has powers generally to collect, treat, dispose of sewer and waste waters, independently or in cooperation with other public agencies. The District also may use its water or land resources for recreational purposes. In the area of power generation, the water district is empowered to construct, maintain and operate hydroelectric power plants and transmission facilities, and may lease facilities and sell power to public agencies engaged in the distribution of electric power. However, the District does not have powers to sell electric power to consumers other than a public utility. In performing its duties, the District has the authority to set rules and levy assessments.

While the District depends an the primary use of the Salton Sea as a repository for floodwater, agricultural drainage water and domestic waste water, the District does not have authority over conditions of the Sea itself. Water elevation and salinity levels affect District operations only in so far as they interfere with drainage and discharge facilities and recreational resources.

The District supports efforts to protect and preserve the recreational resources of the Salton Sea, provided that such measures do not impact the function of the Sea an a repository for irrigation drainage waters. The District also has indicated that it supports investigations and measures to control water quality and water surface elevations in the Salton Sea generally. In response to recent flood related damages in the Salton Sea area, the District has taken the general position that the federal government is responsible for damages attributable to increased sea levels.

Under the no action alternative and other project alternatives, the District will continue to operate and maintain its water supply and drainage facilities according to the statutory and management duties outlined above, and will continue to pursue various programs for water conservation and improved efficiency.

Under the no action alternative, inflows to the Sea will decrease over time as irrigation practices in the area improve under regulatory and market pressures. While decreased water levels can help ensure the proper functioning of the Districts discharge facilities, and to reduce flood related property damages in the Salton Sea area, increased salinity levels associated with reduced inflows could have a negative impact on the recreational values of the Sea. It is possible that the District would participate jointly in measures to reduce salinity and protect recreational facilities, but the exact nature and extent of involvement cannot be predicted at this time. The District's potential responsibility for damage to the Sea caused by irrigation return flows is similar to that of the Imperial Irrigation District, discussed in Section IV.G.l.

Under the "in-sea evaporation" option, the impoundment and evaporation of Sea water within the diked area is likely to result in a gradual lowering of the Sea level and a dilution of salinity concentration in the Sea. The rate of decrease in sea level will depend on the rate at which Sea water is pumped into the impoundment relative to

the rate of at which drainage water flows into the Sea. The involvement of CVWD could be triggered through impacts related to land ownership, changes in water level and increased salinity. If Sea levels increase (as might be the case if inflows to the Sea exceed water removal), facilities CVWD's water management facilities adjacent to the Sea might be affected. The district could exercise its authority to acquire property rights to protect against any potential flood damage claims. Construction and operation of the diked area will not involve District owned lands on the Salton Sea bed.

The in-sea evaporation option is designed to reduce salinity by isolating and evaporating water in a containment area at a rate which exceeds the rate of agricultural inflow into the Sea. The effectiveness of this option is dependent on drainage inflows with a lower concentration of salts than salinity levels in the Sea. If this dilution effect is offset by any additional concentration of salts, even for a short period, recreational values might be impacted. CVWD has indicated that it will, support measures to protect these values.

The CVWD might become involved in the "pump out evaporation" option through issues of land management and ownership, a change in water level, and the production and transmission of electricity. The discussion of this option relative to the authority of the Imperial Irrigation District generally applies in this case. Briefly, construction of the evaporation area on District owned lands would require the approval of the District. A proposal to use or reroute existing drainage pipelines or canals to directly convey return flown to the evaporation site also would require District approval and involvement. As previously discussed, a change in sea levels due to pumping might trigger District actions to acquire additional property or easements adjacent to the Sea, particularly in areas where District owned water management facilities are located.

The CVWD has the authority to maintain and operate. hydroelectric power plants and ancillary transmission lines. Under County Water District Law the District may lease, , sell or use power plants for power generation but may only offer power for sale to other public agencies or utilities. If the 25MW solar energy power plant proposed an part of this option is to be located within the CVWD jurisdiction, it is not clear that CVWD would have the authority to operate and maintain the facility.

The "pump out discharge" alternative would necessitate CVWD, involvement if project related activities or facilities were constructed on or interfered with property owned by the District, if the construction and operation of the project required delivery of electric power supplies by the District, or if Sea level elevation changed as a result of water exchanges between the Salton Sea and the Gulf. It is most likely that the canal would be constructed from the southern end of the Sea and would not impact lands within the jurisdiction of the Coachella Valley Water District. The discussion of this option relative to the involvement of the Imperial Irrigation District analyzes these areas of potential involvement in more detail.

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Appendix G

A Review of the Potential Biological Responses to Salinity Changes in the Salton Sea

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1.0 INTRODUCTION

Salinity levels in the Salton Sea currently exceed that of seawater. Because it is in a closed basin with low

rainfall and high evaporation, the natural tendency of the sea is toward increasing salinity (USDI and RAC 1974, Walker 1961). Increasing salinity has led to concern over the perpetuation of socially and economically important values of the sea, particularly the sport fishery, and concern for the salinity effects of various energy and water development projects (USDI and RAC 1974). Currently, salinity varies in the sea from 38-41 0/00 depending on location and meteorological conditions (i.e. rainfall, air temperature, wind speed, and freshwater inflow from irrigation) (Matsui 1988, personal communication). Salinity is expected to exceed 50 0/00 by the year 2000 (ESE 1982). Future salinity will vary considerably, dependent on decisions made regarding water use, energy and other development in the basin (Dritschilo and Pluym 1984).

Experiments with Salton Sea fish eggs and larvae led researchers to conclude that salinities in excess of 40 0/00 adversely affect development of embryos and larvae of Bairdiella and sargo (Lasker et al. 1972, May 1975, May 1976). Recent observations indicate that in spite of salinities as high as 41 0/00 successful reproduction of these species is still occurring (CDFG 1987). The fact that salinities are approaching potentially harmful levels has led to interest in reassessing our knowledge of the possible response of Salton Sea biota to increasing levels of salinity. The objectives of this report are to review the literature on salinity effects on fish and to provide an opinion on the likely effects of increasing salinity on Salton Sea fishes and lower trophic levels. We also identify what we consider to be important data gaps and outline studies required to provide the needed information.

2.0 STATUS OF PRESENT KNOWLEDGE

2.1 Fishes of the Salton Sea

Since its latest formation in the early 1900's, the Salton Sea has supported changing fish communities. Some of the current fish fauna of the Sea are listed in Table 1.

The corvina, bairdiella, and sargo are introduced from the Gulf of California (Walker 1961). The corvina and bairdiella are in the family Scianidae, a salt-tolerant group including, croakers, seatrout and drum with distribution in nearshore and estuarine temperate and sub-tropical waters. Tilapia is an introduced cichlid (mouth-brooder) from Africa. It may be a hybrid but is probably close to Tilapia mossambica (Glen Black, 1988). They probably entered the Sea through irrigation canals following their introduction in the Coachella Valley. They have a 25-30 day reproductive cycle in warm water and generation times can be as short as 60 days (Bardach et al. 1972). They can reach a size of 3.5 pounds in the Salton Sea (G. Black, CDFG, personal communication). Tilapia are an important sportfish and are also currently the major food of corvina. They are somewhat limited by low winter temperatures which can cause large die-offs. The threadfin shad are a freshwater species which cannot reproduce in the Sea. Apparently all recruitment is through the irrigation canals. These are a potentially important food source for the Sea's sportfish though they are no longer very abundant.

The desert pupfish is the only species which may be considered native to the Sea. They can be quite abundant in nearshore areas and tributary streams. The pupfish may be among the last to disappear under conditions of increasing salinity. Walker (1961) reports they are abundant in hypersaline pools behind wave built sand bars and have been observed to spawn in these pools at salinities in excess of 70 0/00. Black (1980) noted that pupfish were no longer abundant in these pools and may now be extinct in nearshore areas of the lake. They are found in some tributary creeks (notably San

Felipe and Salt Creek) though in low numbers. Present low abundance of the pupfish is believed to be related to interference from introduced species such as the sailfin molly (G. Black 1988).

Table 1. Selected fishes currently inhabiting the Salton Sea, California.[1]

Species name	Common name	Status
Cynoscion xanthulus	Orangemouth	popular gamefish

	corvina	
Bairdiella icistius	bairdiella	sportfish; forage for adult corvina
Tilapia mossambica	tilapia	sportfish; major forage for corvina, has replaced bairdiella in importance
Anisotremus davidsoni	saargo	gamefish; forage for corvina
Cyhprinodon macularis	desert pupfish	California endangered species, Federally endangered species
Gillichthys mirabilis	longjaw mudsucker	forage for adult corvina; bait
Dorosoma pretenense	threadfin shad	potential forage; connot reproduce in Sea, declining
Gambusia affinis	mosquitofish	forage for corvina when available
Poecilia sp.	molly	

[1]Nomenclature in this table and throughout report follows Robins et al. 1980.

2.2 Response of fishes to salinity changes

Fishes in saline waters must maintain the proper concentration of salts in the body fluid and prevent excessive loss of water (see Parry 1966, Conte 1969 for basic physiology of osmoregulation). This requires various adaptive mechanisms and the expenditure of energy since the osmotic concentration in fishes is less than that of sea water. Osmoregulatory mechanisms include drinking water and excretion or secretion of accumulating salts. These mechanisms are aided by limited skin permeability of marine adapted fish.

Fish vary in their ability to osmoregulate in high salinity waters. The highest salinity at which living fish have been reported is the occurrence of Cyprinodon variegatus at 142.4 0/00 (Simpson and Gunter, 1956). Some species can tolerate a wide range of salinities (euryhaline) by tolerating a certain degree of change in the body fluids or well developed osmoregulatory mechanisms.

Fish can acclimate to salinity changes through behavioral and physiological means. The time required for acclimation ranges from hours to days and varies by species (Parry 1966). The upper limits are set by physiological constraints of the individual organism.

Some fish which generally have a narrow tolerance range for salinity can be acclimated by very gradual changes to salinity well outside that range. Tilapia mossambica, a freshwater species, has been acclimated to salinity as high as 69 0/00 (Parry 1966). In general, because of less ability to osmoregulate, fish eggs and larvae are usually more restricted in the conditions of salinity which can be tolerated (Parry 1966). However, actual data for this lifestage are very limited.

Slow changes in salinity can be expected to select individuals and strains with increased salt tolerance. This adaptation would of course depend on the rate of change in the environment, the generation time of the organism, and the degree of variability in the population for traits which influence salinity tolerance. (Are there salt tolerant genes in the genetic pool)? Selection potential is a difficult parameter to forecast and little data exists. Theoretical approaches are possible. Heuts (1947) found that the rate of development of eggs of Gasterosteus aculeatus in different salinities depended on the race of the female parent. The potential can, to some degree, be evaluated using, bioassay studies. However, individuals have to be brought through several generations to see if salt tolerance breeds true is inherited.

2.3 Salinity tolerance studies for Salton Sea fishes.

Lasker et al. (1972) studied tolerance of eggs and larvae of Bairdiella and sargo. Hanson (1970) studied tolerance of the young of Bairdiella, corvina, and sargo. No studies for eggs and larvae of corvina and no studies of Tilapia from the Salton Sea could be located.

2.3.1 Eggs and Larvae

Lasker et al. (1972) measured the response of eggs and larvae of Bairdiella and sargo to high salinities. These experiments produced rather mixed results and must be regarded as inconclusive. The experiments suffered from a lack of well developed protocols and incorporated several confounding variables. These included use of antibiotics in some experiments, use of hormone induced ovulation in others, different methods for collection and fertilization of eggs. In addition no consideration was given to the possible interaction of temperature and salinity and its effect on survival. All tests were conducted at 21ûC. The effect of salinity increase may be greater or less at different temperatures (Heuts 1947, Alderdice and Forrester 1968). Temperature and salinity may also interact with other factors such as parasitism (Moles and Pella 1984) and concentrations of toxic substances (Bryant et al. 1984) to influence mortality.

Lasker et al. (1972) do not report dissolved oxygen concentrations in their experiments. Since oxygen is less soluble in higher salinity waters this may have influenced their results. The study also did not report pH. During the evaporation of seawater pH increases, reaching a peak at about 70 0/00 and thereafter decreasing, (Copeland, 1967). This may also influence the survival of eggs and larvae. The actual pH of Salton Sea water may be quite different, being influenced by biological processes in the Sea.

Finally, there is some evidence that the salinity exposure of the parent fish and that to which the eggs are first exposed result in adjustments in the eggs that persist throughout the lives of fish hatched from those eggs (Kinne 1962). Although not clearly stated in Lasker et al. (1972), it appears that all eggs were obtained from fish acclimated to Salton Sea water of about 37 0/00. The effect of higher acclimation salinities on survival of eggs and larvae exposed to different salinities was not addressed.

Lack of standardization in the experimental techniques led, not surprisingly, to inconclusive results. In the Bairdiella experiments survival at 35 0/00 (presumably a control) ranged from 0.0 to 50.5%; at 40 0/00 from 0.0 to 52.5%; at 45 0/00 from 0.0 to 47.0%; and at 50 0/00 from 0.0 to 16.4%. In any given experiment, mortality did tend to increase at higher salinities. Use of antibiotics seemed to result in poor survival at all salinities.

The sargo experiments were also inconclusive. Survival for fish in 35 0/00 salinity ranged from 0 to 90%. In one experiment, survival was 90% at a salinity of 35 0/00, dropped to 8% at 45 0/00 and was 0% at all higher salinities. In another experiment survival was 13% at 35 0/00, 10.6% at 40 0/00 and then increased in salinities of 45, 50 and 55 0/00 to 36%, 41% and 51% respectively.

May (1975, 1976) had greater success at keeping, Bairdiella alive in the lab and found diminished reproductive success of Bairdiella at 40 0/00.

2.3.2 Young

Hanson (1970) conducted 96-hour shock bioassays and an 8-day bioassay following acclimation to higher salinities (for Bairdiella only) on young-of-year fish. Acclimation salinities and acclimation schedules are not reported. There was only one replicate for each test and only combined results are reported. Concentrations of dissolved oxygen and pH were not reported.

Survival of young-of-year Bairdiella was 100% at 52.5 0/00 and dropped to 40% at 55 0/00. Survival of yearling, Bairdiella was 100% at 45.0 and fell to 60% at 52.5 0/00 (intermediate salinities were not tested), however, these fish could be acclimated to 58 0/00.

Young-of-year corvina experienced 100% survival at salinities less than or equal to 52.5 0/00 although survival remained above 90% at salinities up to 57.5 0/00.

Results for sargo were ambiguous but indicate that sargo may be less tolerant of high salinities than the other two species.

2.4 Known salinity distribution of selected Salton Sea biota

In the absence of definitive studies on the tolerance of Salton Sea fishes to salinity increases and in the absence of any studies on the salinity tolerance of some of the Seas' other biota it may be possible to derive some expectations for changing community composition based on the known distribution of these or related biota in environments of differing, salinity.

Distribution data may provide only a conservative estimate of the salinity range tolerated by a species. Naiman et al. (1975) found that though Death Valley pupfish (Cyprinodon millei (=salinus) could tolerate salinities of 88 0/00, they were rarely found in nature at salinities over 45 0/00, perhaps due to limited reproduction.

Corvina

No distribution data for Cynoscion xanthulus related to salinity were found, however, several reports for related species were found. Edwards (1976) found juvenile white seabass, Cynoscion nobilis, in a lagoon on the Pacific Coast of Mexico where dry season average monthly salinity was measured as high as 60 0/00 but where lower salinity water was usually available (-35 0/00). The actual salinity at the time and location of collection of these fish is not reported. Spotted seatrout, Cynoscion nebulosus, were captured in water with salinity as high as 57 0/00 in the Upper Laguna Madre, Texas (Hellier 1962). The age of these fish (i.e. young-of-year, juvenile, adult) is not reported. Breuer (1957) reports that Cynoscion nebulosus in Baffin Bay, Texas are conspicuous by their absence when salinities reach 55 parts per thousand, though he presents no data to support this statement. In contrast, Simmons (1957) found limited numbers of C nebulosus adults in salinities of 25 0/00 to 75 0/00 and temperatures of 4û C to 33û C in upper Laguna Madre, Texas. He also found that smaller individuals were present in all months though combinations of high salinity and high temperatures limited their numbers. Simmons indicates that C. nebulosus did not spawn in waters above 45 0/00 though he presents no supporting data. He does remark that they were very sensitive to crowding from other fish.

Bairdiella

Hellier (1962) took specimens of silver perch (Bairdiella chrysura) in salinities as high as 56.8 0/00 at a temperature of 31û C in the upper Laguna Madre, Texas. Simmons (1957) found silver perch in the same location only in salinities of 45 0/00 or less.

Sargo

No reports on the salinity distribution of Anisotremus were located.

Pupfish

Deacon and Minckley (1974) report that Cyprinodon atrorus tolerates 95 0/00 salinity in Cuatro Ciengas basin, Mexico and Cyprinodon sp. survive 78 0/00 salinity in Cottonball Marsh, Death Valley, California. Simmons (1957) found the killifish (Cyprinodon variegatus) very commonly in waters from 5 to 75 0/00 at all temperatures in the upper Laguna Madre, Texas. Simpson and Gunter (1956) collected over 2000 specimens of C variegatus in a salinity of 142.4 0/00. Renfro (1966) successfully hatched eggs of C variegatus in the laboratory in salinity peaking at 110 0/00 with temperatures ranging from 17.4ûC to 27.5ûC. Barlow (1958) found that young fry of C macularius continue to develop at a salinity of 90 0/00 but that adults died at lower salinities. Kinne (1962) found successful hatching in salinities up to 70 0/00 for this species while adults could tolerate salinities of 80-85 0/00.

Tilapia

Fishes of the genus Tilapia are highly variable in their tolerance of salinity and individual- species may themselves be quite plastic in their response. Hammer (1987) cites reports that T mossambica from Lake Ihotry,

Madacrascar have an upper tolerance of 20-30 0/00. T mossambica introduced to Indian waters survived direct transfers from freshwater tanks to 50% and 100% seawater. After acclimation they could tolerate salinities of 65 0/00 (Ramamurthi, cited in Hammer 1987). Bardach et al. (1972) indicate that T mossambica can breed in seawater (we assume this is 35 0/00 salinity) though it is not reported whether this is the upper limit. It is also not clear whether the authors observed breeding behavior at these salinities or the successful production of young; the distinction is important. Gerking and Lee (1980) found that while mating behaviors by both sexes of Amargosa pupfish (Cyprinodon nevadensis) and females lay a few eggs in salinities as high as 43 0/00, both egg production and egg viability fell to very low levels above 20 0/00 salinity.

2.5 Trophic Considerations

Increases in the salinity of the Salton Sea could effect fishes indirectly well before reproductive failure or mortality of adult fish occurs. Biologically, the sea is a relatively simple system. Food webs are short and lack diversity (Walker 1961). In such a system, changes in the lower trophic levels, can dramatically effect abundance of top predators such as corvina. For example, the major source of food for corvina has been Bairdiella. Bairdiella depend almost entirely on the benthic worm, Nereis (= Neanthes). Adult corvina may tolerate salinities as high as 75 0/00 and adult Bairdiella as high as 58 0/00. If reproductive success of Nereis is threatened at 50 0/00, both these species will disappear at salinities over 50 0/00 (in fact, reproductive failure of Bairdiella will likely occur first). In such a scenario, corvina may be able to switch to an alternate prey source such as Tilapia. Such a switch is apparently happening in the Sea now (G. Black, CDFG, personal communication). Because of behavioral or distributional characteristics of predator and prey, switching may not always be possible (Hagar 1984, Kitchell and Crowder 1986, Jude et al. 1988). In simple food chains the fate of the top predator is governed by the weakest link in the chain.

More important trophic links may be found in the Seas plankton community. Though considered relatively unimportant to the Seas top predators (Walker 1961), trophic relations of the early life stages of these species may be critical and may cause changes well before salinity reaches critical levels for the fish. Although adult corvina feed heavily on Bairdiella and other fish prey, the juveniles must subsist for their first year on copepods, barnacle nauplii, other zooplankton and Nereis. These trophic interactions must be considered in anticipating the likely effects of increased salinity yet they are extremely difficult to quantify and difficult to predict in any rigorous way.

In general increasing salinity, results in the decline of species numbers, but abundance of remaining species may be great (Carpelan 1967, Copeland 1967, Hammer 1987). In hypersaline waters nutrients are also concentrated by evaporation and may lead to high levels of productivity (Copeland and Nixon 1974, Hammer 1987). In plankton, species differ in their tolerance to salinity with some preferring fresher waters, some preferring high salinity and some having a very wide range of tolerance. The pattern is consistent for phytoplankton, zooplankton and other invertebrates. Under conditions of increasing salinity we would expect some species to disappear and some to increase therefore leading to changes in community composition over time, but an overall trend to fewer species (Table 2). These changes would necessitate modified food webs. Carpelan (1964) found that the distribution of algae in supersaline ponds limited the distribution Artemia (brine shrimp) feeding on it in spite of suitable salinities for Artemia.

Table 2. Numbers of species of major groups of plants and animals found in waters of different salinity in World athalassic saline waters. (data from Hammer 1987).

	Salinity (‰)								
Group	30	40	50	60	70	80	90	100	100+
Bacillariophyta	23	-	14	-	-	-	-	14	12
Chlorophyta	19	-	14	-	-	-	-	13	5
Chrysophyta	1	-	1	-	-	-	-	0	0

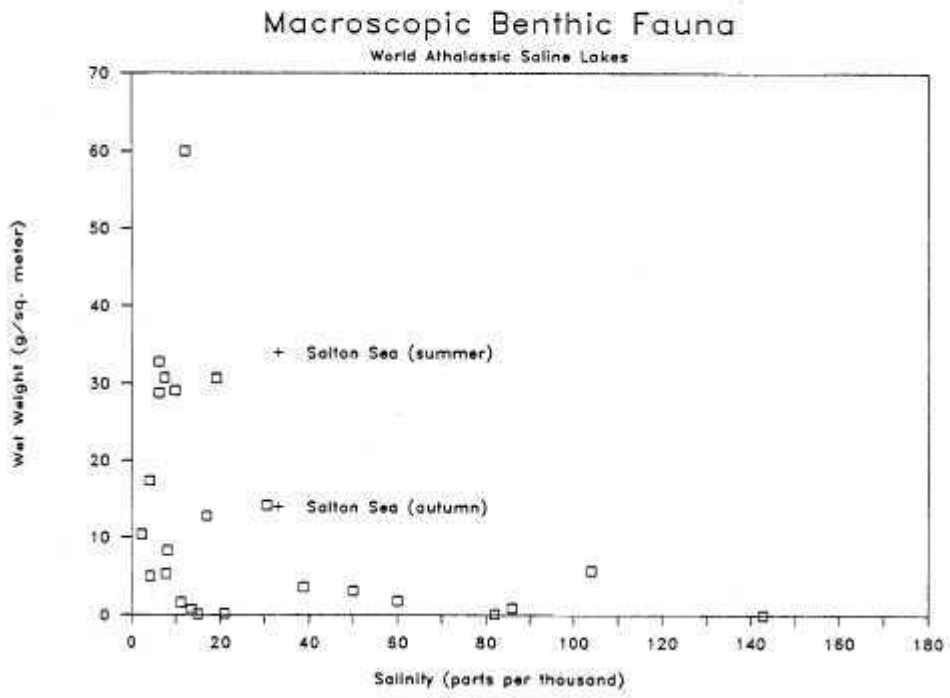
Cryptophyta	0	-	1	-	-	-	-	0	0
Cyanophyta	19		10	-	-	-	-	5	4
Euglenophyta	1	-	0	-	-	-	-	0	0
Pyrrophyta	3	-	3	-	-	-	-	1	0
Rotifera	20	8	6	4	3	2	2	0	
Anostraca	15	11	7	5	5	5	5	5	
Cladocera	14	11	6	5	3	1	1	1	
Copepoda	26	20	19	19	14	11	10	8	
Protozoa	48	-	30	-	-	-	-	26	
Insecta	14	7	7	6	5	4	2	2	
Mollusca	2	2	2	2	2	2	1	1	
Ostracoda	28	22	18	18	17	14	14	13	

Walker (1961) describes four major planktonic animals of the Salton Sea: rotifer, Brachionus plicatilis; barnacle, Balanus amphitrite; cyclopoid copepod, Cyclops dimorphus; and nereid worm, Nereis succinea (pileworm). Brachionus plicatilis is the most ubiquitous rotifer in saline 19kes (Hammer 1987). Hammer documents its occurrence on every continent except Antarctica in waters from 3 0/00 to 250 0/00 salinity. It lives in Mono Lake, California in salinity to 90 0/00 and appears to be tolerant of the dominance of various anions as well as a wide spectrum of salinity. Balanus amphitrite saltonensis was described by Rogers (1949) as a subspecies of the cosmopolitan complex found only in the Salton Sea. Recent biochemical investigations indicate that there is no significant genetic differentiation of B. a. saltonensis from B. a. amphitrite populations sampled over a wide geographic range (Flowerdew 1985). Simmons (1957) found B. amphitrite in salinities of 25 to 75 0/00 though he remarks it was more abundant in waters of lower salinities. He also found the polychaet worms, Nereis pelagica occidentalis and Polydora ligni, withstanding, salinities of 75 0/00. Oglesby (1988) found reproduction of Nereis succinea was threatened at 4550 0/00. Little is known of the salinity tolerance of Cyclops dimorphus. It is a freshwater form thought to have entered the Salton Sea via the lower Colorado River. Other members of Cyclops occur in salinities from less than 13 0/00 to over 100 0/00 (Hammer 1987). Three of the four Cyclops species reported in Hammer have distributions in salinities less than 30 0/00.

Nereis are a very important layer in the trophic structure of the Salton Sea. They provide one of the few links between primary production in the plankton and higher trophic levels (Walker 1961). Hammer (1987) lists the abundance and biomass of benthic organisms from saline lakes of the world. This data is plotted in Figure 1. by salinity of these lakes. The data indicates that lakes with salinities in the range of 0-30 0/00 can be very productive for benthic organisms but that over 30 0/00 salinity lakes are not as productive. The reasons are probably variable and no firm conclusions can be drawn. Walker (1961) provides some data which allow us to compare the Salton Sea to these other lakes. By his estimates the standing crop of Nereis varies between 14 g/m2 in the autumn to 34 g/m2 in the summer. This is well above estimates for other saline lakes and does not account for any of the biota besides Nereis.

Declines of a pileworm standing crop to levels approaching those of other saline lakes would certainly have a devastating effect on fish populations dependent on this production. Though we cannot say for certain at what level this would occur, it should happen before pileworm reproduction is threatened at 45 ‰.

Figure 1: Standing crop (S/m² wet weight) of macroscopic benthic fauna from some athalassic saline lakes of the world.



Dritschilo and Pluym (1984) put together sophisticated ecotoxicological model of the Salton Sea. The model is an elaboration of a Ricker (1954) type recruitment model elaborated into a leslie matrix and tied to trophic considerations. Unfortunately the data to calibrate or validate the model are not available and the model incorporates a number of assumptions and toxicological relationships that are questionable. The model is presented more as a conceptual approach than an actual predictive tool although simulations are presented.

3.0 DATA GAPS AND RECOMMENDED STUDIES.

Important data claps are listed below in what we believe to be priority ranking. Studies relate to identification of impacts. We recognize that some of these studies may involve long time periods and extensive expenditures. We do not contend that all of these studies are necessary before any meaningful management actions are taken.

1. Salinity tolerances for Sargo and Corvina (studies ongoing).
2. Monitoring, pileworm standing, crop, production and salt tolerance.
3. Tilapia studies including food web, reproduction and salt tolerance.
4. Monitor other trophic levels.
5. Expand salt tolerance studies to look at synergistic and cumulative effects (some studies proposed).
6. Study in situe hypersaline lagoons for ecological responses and tolerances.
7. Expand tolerance studies to assess adaptation and selection potential.

Conducting some or all of these studies would greatly improve our confidence in forecasting population and ecosystem responses to future conditions of salinity. As discussed, given the simplicity of the food webs any major shift in the trophic structure is likely to lead to effects on recreationally important species.

Studies related to mitigation assuming unavoidable salinity increases:

1. Research potential for Corvina/Sargo hatchery-artificial propagation.

2. Research potential for the introduction of alternative salt tolerant prey base (hypersaline lagoon pileworms and possibly shrimp).

These studies would provide some insurance for avoiding catastrophic loss of the fishery resources and establish contingency strategies if predicted salinity tolerances for target species are overestimated or if food webs collapse.

The California Department of Fish and Game has funded the Vantuna Research Group at Occidental College for studies of the Salton Sea. These studies have two main objectives: identification of major spawning and nursery areas and determination of levels of salinity that may be detrimental to reproduction of sargo and corvina in the Salton Sea. These studies are scheduled for completion in 1990. Dose-response studies for selenium have been proposed but have not yet been funded.

Salinity levels detrimental to reproduction of sargo and corvina will be determined by laboratory bioassay techniques. These studies will consider the effects of acclimation salinities and will control for temperature, oxygen, and pH effects.

4.0 IMPACT ANALYSIS

Based on the preceding, review of the literature we have proposed the following generalized model for changes in the Salton Sea biota in response to levels of salinity increasing from present levels. The analysis presented should be construed as professional opinion. Our crystal ball in this case is not very clear. Our ability to predict future biological conditions even given rigorous empirical data is lackluster and wrought with error. Dynamic ecological systems do not behave according, to simple sets of linear relationships. Relationships are non-linear and change over time as different factors become limiting. If you could mathematically define such relationships (a quantitative model) there would be multiple correct solutions (possible futures). Ecosystem responses are not necessarily deterministic but incorporate elements of chaos and uncertainty. With imperfect knowledge we proceed to assess the biological ramifications of increased salinity.

Existence in saline waters usually requires some degree of osmotic regulation. Though most organisms in the Salton Sea are adapted for life in saline waters, osmoregulation requires the expenditure of an organisms energy. As conditions depart from optimum, greater expenditures are necessary for osmoregulation. These expenditures compete for other physiological demands such as growth, reproduction, resistance to disease and parasitism and other environmental stresses such as temperature extremes and toxic substances. Studies by Brocksen and Cole (1972) indicate that in short term studies (two weeks with two week acclimation period) Bairdiella and sargo experience reduced growth efficiency and increased maintenance requirements as salinity departs from optimum (37 and 33 0/00 respectively). They also found that respiration increased and food assimilation decreased for yearling corvina as salinities departed from 37 0/00. As salinity increases toward an organisms upper tolerance level (the point at which death occurs) the risk of death due to these other factors also increases.

As an example, Tilapia currently experience episodes of mortality due to cold temperatures in the winter though not all the fish die every year (G. Black, CDFG, personal communication). As salinity increases, at some level we may expect to see greater susceptibility to this temperature stress and higher levels of mortality associated with it. This is also true for other fish in the Sea (i.e. bairdiella, corvina, sargo, and Tilapia) which experience high mortalities during the summer. This mortality has occurred regularly since these fish were first introduced to the Sea. The cause is not well known but is believed to be associated with high winds and mixing of the water column with high levels of hydrogen sulfide (produced in the sediments), and presumably low dissolved oxygen, mixed into surface waters. This is also a rather localized occurrence and does not effect all the fish. Under conditions of increasing salinity, these other environmental stresses may become increasingly damaging in a synergistic manner.

We have defined four circumstances under which a species existence in the Sea may become threatened due to

increases in salinity:

1. The level at which other factors interact with salinity to cause excessive mortality,
2. The loss of primary food supply due to exceedance of salinity tolerance for that organism,
3. Reproductive failure,
4. Direct mortality due to exceedance of salinity tolerance.

We have almost no information on factors 1 and 2. Further increases in salinity can only increase the level of risk for those species which currently experience mortality related to environmental stress. Changes in the trophic structure of the sea are probably ongoing and the risk of these changes reaching a magnitude that exceeds the level of environmental variability and leads to significant restructuring of trophic relationships, also increases with increasing salinity. For some species the salinities at which factors 3 and 4 become important have been examined, though there is also a degree of uncertainty there. Often the ranges are vague and even where they are not, the importance and limits of selective forces are unknown. As conditions depart further from the present the number of possible events expands and our ability to accurately predict them diminishes dramatically.

In any case, we have provided an assessment indicating some of the more important shifts which are likely to occur as salinity increases (Table 3). As discussed previously, our assessment is soft and should be viewed as professional opinion. The assessment assumes that no new species are introduced, that corvina may be sustained in the Sea past the point of reproductive failure by artificial propagation, and that no significant reproduction by any species occurs in areas outside the Sea (i.e. irrigation canals).

Table 3. Hypothetical chronology for salinity effects on Salton Sea Biota.

Salinity	Event	Probability
40	Increased importance of environmental stress on all fish.	high
	Reproductive failure of Bairdiella, sargo, and tilapia due to excessive salinity.	moderate
	Declining abundance of primary forage for corvina due to above with resulting lower growth rates, decreased reproduction and higher mortality.	moderate
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	moderate
	Changes in lower trophic levels effecting ecruitment success of corvina and other fish	low
45	Reproductive failure of Bairdiella, sargo, and tilapia due to excessive salinity.	high
	Loss of reproduction of tilapia due to excessive salinity.	moderate
	Reproduction of pileworm threatened	moderate
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	moderate
	Direct mortality to young and/or adult Bairdiella and sargo due to excessive salinity	moderate
	Declining abundance of primary forage for corvina due to above with resulting ower growth rates, decreased reproduction and higher mortality.	moderate
	Loss of recruitment of corvina due to reproductive failure at upper salinity tolerance.	moderate
	Changes in lower trophic levels effecting recruitment	

	success of corvina.	low-moderate
50	Reproduction of Bairdiella and Sargo no longer possible.	high
	Loss of reproduction of pileworm.	high
	Declining productivity (standing crop) of Nereis reduces food for Bairdiella, young corvina.	high
	Exceedance of upper salinity tolerance for high adult sargo.	high
	Total loss of sargo.	high
	Total loss of Bairdiella.	high
	Loss of recruitment of corvina due to reproductive failure at upper salinity tolerance.	high
	Loss of forage for corvina, corvina fall to low numbers.	high
	Loss of corvina sport fishery.	high
	Reproductive failure for Tilapia.	moderate-high
	Total loss of food source for Bairdiella.	moderate
	Exceedance of upper salinity tolerance for adult Bairdiella.	moderate
55	Conditions intolerable for adult corvina due to lack of forage, corvina at very low numbers.	extreme
	Reproductive failure of Tilapia.	high
	Total loss of corvina.	moderate
	Conditions intolerable for adult corvina due to high salinity for adults.	low-moderate
60	Tilapia success is highly variable from year to year due to interaction of salinity and other environmental factors.	extreme
	Corvina at very low numbers due to lack of forage, environmental stress, no reproduction.	extreme
	Total loss of corvina.	high
65	Total loss of corvina.	extreme
70	Tilapia adults can no longer tolerate high salinities (regardless of other environmental factors).	high
	Reproductive failure of desert pupfish.	high
	Loss of barnacle.	high
	Phytoplankton and zooplankton communities have lost some species, perhaps gained a few new ones. Species diversity is lower. No fish from previous community remain, with possible exception of desert pupfish.	high

5.0 MANAGEMENT/POLICY SUGGESTIONS

Briefly we have outlined some measures that may assist decision makers on the difficult choices they have before them.

As there is a great deal of uncertainty regarding the actual versus the predicted responses of the Salton Sea communities to increase salinity, we strongly urge that a monitoring, program be put in place that focuses on the target species as well as other important trophic elements (pileworms, zooplankton, tilapia). This would allow us to assess whether our predicted responses are accurate and allow the calibration and validation of predictive models. In other words, any set acceptable salinity level should be tied to population monitoring as an insurance for our murky soothsaying, abilities.

We suggest the development of an interim plan that includes the development of artificial propagation methods and facilities. This is possible right now. Also, the development of a strategy, should food webs begin to fail, that may include the introduction of alternative more salt tolerant species. In most cases we would be opposed to the introduction of new species into an aquatic ecosystem as they are already overburdened with transplants and exotic species that have extirpated or greatly reduced native species. The Salton Sea is special. It is a manmade body of water with, in part, a manmade ecosystem. We believe the introduction of new species should be done only as a fall back position but that the necessary research and planning be conducted now.

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