DRAFT

SALTON SEA RESTORATION PROJECT ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT

January 2000

Prepared for:

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and

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LIST OF ACRONYMS

Acronym	Full Phrase
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ACOE	US Army Corps of Engineers
af	acre-feet
af/yr	acre-feet per year
AIRFA	American Indian Religious Freedom Act
APCD	Air Pollution Control District
APE	area of potential effect
AQMD	Air Quality Management District
ATC	authority to construct
Authority	Salton Sea Authority
BA	biological assessment
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practices
BOD	biological oxygen demand
BRAC	Base Realignment and Closure Act
CAA	Clean Air Act
CARB	California Air Resources Board
CASI	Central Arizona Salinity Interceptor
CDFG	California Department of Fish and Game
CDMG	California Department of Mines and Geology
CDP	California Desert Plan
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
CHRIS	California Historical Resources Information System
CIMIS	California Irrigation Management Information System
CMP	Congestion Management Plan
CNPS	California Native Plant Society
CO	carbon monoxide
COHP	California Office of Historic Preservation
CRB-RWQCB	Colorado River Basin Region Water Quality Control Board
CRHR	California Register of Historical Resources
CVWD	Coachella Valley Water District
CWA	Clean Water Act
DWR	California Department of Water Resources
ECVP	Eastern Coachella Valley Plan
EES	Enhanced Evaporation System
EIS/EIR	environmental impact statement/environmental impact report
EO	Executive Order
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FHWA	US Federal Highway Administration
FLPMA	Federal Land Policy Management Act of 1976

LIST OF ACRONYMS *(continued)*

Acronym	Full Phrase
FPPA	Farmland Protection Policy Act
FTA	US Federal Transit Administration
FWQA	Federal Water Quality Administration
g	gravitational acceleration
Gateway	The Gateway of the Americas Specific Plan Area
GIS	geographic information system
HCP	habitat conservation plan
I	Interstate
IBWC	International Boundary Water Commission
IID	Imperial Irrigation District
INAH	Instituto Nacional de Antropología e Historia
IRMP	integrated resource management plan
ITA	Indian Trust Asset
kaf/yr	thousand-acre-feet per year
KGRA	geothermal resource area
kv	kilovolt
KVOP	key visual observation points
LESA	land evaluation and site assessment
LOS	level of service
maf	million acre-feet
maf/yr	million-acre-feet per year
mg/L	milligrams per liter
ml	milliliters
Modeling Group	Water Resources and Environmental Modeling Group of the Department of Civil and Environmental Engineering
mph	miles per hour
msl	mean sea level
MW	megawatt
MWD	Metropolitan Water District
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	notice of availability
NOD	notice of determination
NOx	nitrogen oxides (nitric oxide plus nitrogen dioxide)
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
OHV	off-highway vehicle
PL	Public Law
PM_{10}	inhalable particulate matter
$PM_{2.5}$	fine particulate matter
POE	Port of Entry

LIST OF ACRONYMS *(continued)*

Acronym	Full Phrase
ppm	parts per million
Project	Salton Sea Restoration Project
PTO	permit to operate
PWC	personal water craft
Reclamation	US Department of the Interior Bureau of Reclamation
RMC	Research Management Committee
ROD	record of decision
ROG	reactive organic compounds
RPLI	Regional Paleontological Locality Inventory
RTIP	Regional Transportation Improvement Program
RWQCB	regional water quality control board
SCAG	Southern California Association of Governments
SDCWA	San Diego County Water Authority
SHPO	State Historic Preservation Officer
SIP	state implementation plan
SOx	sulfur oxides
SR	State Route
SRA	State Recreation Area
SRMNSA	Santa Rosa Mountains Natural Scenic Area
SSC	Salton Sea Science Subcommittee
SSP	Strategic Science Plan
STIP	State Transportation Improvement Program
SWRCB	State Water Resources Control Board
TCP	traditional cultural property
TDS	total dissolved solids
TMDL	total maximum daily load
TSP	total suspended particulate matter
TUA	traditional use area
UC Davis	University of California Davis
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
USMC	US Marine Corps
UXO	unexploded ordnance
VRM	visual resource management
yr	year

EXECUTIVE SUMMARY

SALTON SEA RESTORATION PROJECT BACKGROUND

Salton Sea Facts

- Located south of Palm Springs in Imperial and Riverside counties
- Surface elevation is 227 feet below mean sea level
- Deepest area of the Sea bed is only five feet higher than lowest point in Death Valley
- Surface area is 365 square miles
- Contains 7.5 million acre-feet (maf) of water
- Evaporates 1.36 maf each year
- Salinity is 44,000 mg/L, compared to 35,000 mg/L for sea water
- All values are approximate and fluctuate with time

The Salton Sea is an excessively salty, nutrient-rich lake in a closed basin. The Sea exists primarily due to continued agricultural drainage from the Imperial, Coachella, and Mexicali valleys and smaller contributions from municipal effluent and stormwater runoff. The Sea has a productive sport fishery and provides important migratory and resident bird habitat within the Pacific Flyway. Seasonal bird use includes millions of birds, and approximately 400 bird species have been recorded at the Sea. Several endangered species, including the desert pupfish, brown pelican, and the Yuma clapper rail, inhabit the Salton Sea or adjacent habitats.

The Salton Sea ecosystem is under stress from increasing salinity, nutrient loading, oxygen depletion, and temperature fluctuations that may be threatening the reproductive ability of some biota, particularly sportfish species, and also causing additional ecosystem health problems. There are indications that the deteriorating environmental conditions may be contributing to the prominence of avian disease at the Sea. Without restoration, the ecosystem at the Sea will continue to deteriorate.

Congress passed Public Law (PL) 102-575 in 1992. The law directs the Secretary of the Interior to "conduct a research project for the development of a method or combination of methods to reduce and control salinity, provide endangered species habitat, enhance fisheries, and protect human recreational values . . . in the area of the Salton Sea." The Salton Sea Reclamation Act of 1998 (PL 105-372) was passed to further the restoration process. PL 105-372 directs the Secretary to "complete all studies, including, but not limited to environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea as a reservoir for irrigation drainage and: (i) reduce and stabilize the overall salinity of the Salton Sea; (ii) stabilize the surface elevation of the Salton Sea; (iii) reclaim, in the long term, healthy fish and wildlife resources and their habitats; and (iv) enhance the potential for recreational uses and economic developments of the Salton Sea."

Developing the Salton Sea Restoration Project requires compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). To satisfy both NEPA and CEQA requirements, the US Department of the Interior Bureau of Reclamation (Reclamation) and the Salton Sea Authority (Authority), as the lead agencies in cooperation with a number of interested agencies, have prepared this joint draft environmental impact statement/environmental impact report (EIS/EIR). Founded in 1993, the Authority is a joint powers authority formed by the Coachella Valley Water District, Imperial County, the Imperial Irrigation District, and Riverside County.

Purpose and Need for the Salton Sea Restoration Project

The purpose and need for the Salton Sea Restoration Project is to maintain and restore ecological and socioeconomic values of the Salton Sea to the local and regional human community and to the biological resources dependent upon the Sea. These requirements are reflected in the directives of PL 105-372. The purpose and need will be met by implementing a project that satisfies the goals and objectives discussed in chapter 1 of this EIS/EIR. The project is intended to have ecological, recreational, and economic benefits.

Salton Sea Restoration Project Goals and Objectives

Prior to implementing the NEPA/CEQA process, the Salton Sea Authority and the Bureau of Reclamation, working jointly with stakeholders and members of the public, developed five goal statements. The goal statements are consistent with the direction contained in PL 105-372, address the underlying purpose and need for the project, and provide guidance for developing project alternatives. The five goals of the Salton Sea Restoration Project are as follows:

1. Maintain the Sea as a repository of agricultural drainage;
2. Provide a safe, productive environment at the Sea for resident and migratory birds and endangered species;
3. Restore recreational uses at the Sea;
4. Maintain a viable sport fishery at the Sea; and
5. Enhance the Sea to provide economic development opportunities.

In order to measure the effectiveness of any actions designed and implemented to achieve the five project goals, specific objectives were developed in cooperation with stakeholders to further define each goal. In many cases, objectives overlap and result in mutual benefits. The goals and objectives have been used to guide the development of alternatives analyzed in this EIS/EIR. These same objectives ultimately would be used to guide efforts to monitor and evaluate the effectiveness of any restoration actions that are implemented.

Issue Identification Through the Public Scoping Process

The identification of issues to be addressed in the EIS/EIR included internal agency review and analysis and the public scoping process. The purpose of scoping is to encourage the public and government agencies to help identify issues and topics that an EIS/EIR should address. In general, the issues and concerns raised during public scoping meetings and additional workshops on alternatives included the following:

- Water quality and quantity;
- Salinity increase;
- Contaminants and public health;
- Aesthetics, particularly odors and visual impacts;
- Long-term management goals;
- Wildlife;
- Agriculture;
- Economic development;
- Recreation;
- Elevation stabilization;
- International boundary issues;
- Cultural and Native American issues;
- Alternative development;
- Timeframe for initiating solutions; and
- Project financing.

All of these issues were considered in developing the content of this EIS/EIR and, where appropriate, are addressed in the document.

Phased Implementation Strategy

The alternative screening and evaluation process has shown that certain components are needed sooner than others and that certain project components can be designed and constructed sooner than other components. For example, water imports will be needed only if future average inflows to the Sea decline; therefore, a phased alternative implementation strategy is proposed. Phase 1 actions would be implemented between the years 2003 and 2015. Phase 2 actions, if needed at all, are generally planned for the year 2030 and beyond. Phase 1 actions have been developed and analyzed in sufficient detail to allow for an appropriate action to be selected after the final version of this EIS/EIR is published. In addition to the EIS/EIR, other ongoing technical studies will be completed and made available to the lead agencies during refinement of Phase 2 actions. Recommendations will be provided by the lead agencies as to which Phase 2 actions should be retained for further analysis, design, and supplemental environmental analysis and documentation.

NO ACTION/NO PROJECT ALTERNATIVE

Project alternatives must be evaluated against a scenario that could reasonably be expected to occur in the foreseeable future if the project is not approved. This evaluation allows decision-makers to compare the effects of approving a project against the effects of not approving a project. The No Action Alternative describes probable future conditions based on the potential for current conditions to continue plus other assumptions about physical, biological, and socioeconomic changes that might occur without the project.

Projecting hydrologic conditions for this project is complicated by uncertainties of future water flows into the Sea. The flow of water will depend on external factors not associated with the Salton Sea Project, and the timing of the flow is unknown. Therefore, for purposes of analysis, project effects have been evaluated against three No Action/No Project inflow scenarios:

- Current (present-day) inflow conditions continue throughout both Phases 1 and 2, with average annual inflows of 1.36 maf/yr;
- Annual inflows are incrementally reduced throughout Phase 1 to 1.06 maf/yr at the beginning of Phase 2; inflows remain at 1.06 maf/yr throughout Phase 2; and
- Annual inflows are incrementally reduced throughout Phase 1 and continue to decline into Phase 2 until they reach 0.8 maf/yr.

These potential future inflows are considered reasonable future scenarios, in light of the varied other projects in the region currently under consideration that may ultimately gain approval and affect the inflow of water to the Sea.

In the future, in addition to changes in the quantities of inflows, the quality of inflowing water may also change. The Clean Water Act requires: (1) identification of the Region's waters that do not comply with water quality standards, (2) ranking of impaired water bodies, and (3) establishment of Total Maximum Daily Loads (TMDLs) for those pollutants causing the impairments. The TMDL process should have a long-term beneficial effect on the quality of waters flowing into the Sea. This benefit is expected to occur under the No Action Alternative as well as under project alternatives. While the project alternatives are focused on restoration of the Sea itself, the TMDL process should enhance the effectiveness of the restoration alternatives by improving the quality of the inflows.

RESTORATION ALTERNATIVES EVALUATED IN THE EIS/EIR

Alternatives have been developed with the recognition that inflows to the Sea may decrease in the future. Thus, each alternative includes actions that would be implemented under the reduced inflows considered. Table ES-1 displays how five complete alternatives have been formulated from individual actions for three inflow scenarios described in the previous section for the No Action Alternative. Schematic representations of all five alternatives can be found in Appendix A. The alternatives are designed to address the wildlife, fishery, and recreation goals and objectives presented in chapter 1. In part, these objectives would be addressed by halting the present trend of increasing salinity and by ultimately reducing salinity to a target concentration of about +/-40,000 mg/L. All alternatives include salinity control measures during Phase 1. For Alternatives 1 and 5, an additional export action would be required to provide long-term salinity and elevation control. This action could be required as early as 2015 for Alternative 1 and is considered an accelerated Phase 2 action.

Alternative 1

Alternative 1 would involve constructing two evaporation ponds within the Sea. The combined surface area of the ponds would be approximately 33 square miles but would depend on the elevation of the water surface in the ponds and seasonal fluctuations. The ponds would act to concentrate the salts from the Sea and to assist in stabilizing the surface elevation. Approximately 98,000 af/yr of water would be pumped into these ponds from the Sea each year. Evaporation of this water would tend to concentrate salts in the ponds and allow the salinity in the remainder of the Sea to be maintained at an acceptable level. The ponds also would create a displacement, which would assist in maintaining the target elevation level of the Sea (+/- -230 feet) should inflows to the Sea decrease in the future. The ponds would be located at the south end of the Sea, with one west of the mouth of the New River and the other by the Salton Sea Test Base.

Alternative 2

Alternative 2 would involve constructing an Enhanced Evaporation System (EES) on a site north of Bombay Beach. The EES is a method to remove salts from the Sea by increasing evaporation rates through spraying. Alternative 2 involves constructing tower modules to process 150,000 af/yr of Salton Sea water. The system would operate on average 18 hours per day and automatically shut down when winds exceed 14 miles per hour (mph). Each module would consist of a line of towers and precipitation ponds.

Alternative 3

Alternative 3 would be similar to Alternative 2 in that it would involve construction of an EES; however, for Alternative 3 the EES would be located at the Salton Sea Test Base.

Table ES-1
Summary of Salton Sea Restoration Project Alternative Actions

Inflow (maf/yr)	----------------------------Phase 1 (before 2030)--------------------------------			----------Phase 2 (2030 and beyond)----------	
	2003	**2008**	**2015**	**2030**	**2060**
Alternative 1					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	2 Ponds at 98 kaf/yr Pupfish Pond	Accelerated Export – 150 kaf/yr[1]		
1.06	Same as above	Same as above	Same as above, plus Displacement Dike	Import Central Arizona Salinity Interceptor (CASI) Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above, plus Import Flood Flows	
Alternatives 2 and 3					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	150 kaf/yr EES (showerline technology)			
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Import CASI Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above	Additional Displacement or Inflow
Alternative 4					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	100 kaf/yr EES 1 Evaporation Pond (S) at 68 kaf/yr Pupfish Pond		Increase EES capacity to 150 kaf/yr	
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Same as above, plus Import CASI Water (up to 304.8 kaf/yr, as required) Reduce EES at 100 kaf/yr	
0.80	Same as above	Same as above	Same as above	Same as above	
Alternative 5					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	150 kaf/yr EES in-Sea Evaporation Pond (N)		Export – 150 kaf/yr	
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Import CASI Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above	Additional Displacement or Inflow

[1] Accelerated export implemented as a Phase 2 action

Alternative 4

This alternative combines the technology of Alternatives 1 and 3 to increase the effectiveness and speed at which salts are removed from the Sea. The EES would be constructed on the Salton Sea Test Base, but the size of the EES would be reduced to a capacity of 100,000 af/yr. The southwest evaporation pond would be constructed as described in Alternative 1.

Alternative 5

Alternative 5 combines an evaporation pond near the Salton Sea Test Base with a 150,000 af/yr EES incorporated within the pond itself. The EES used in this alternative would involve technology typically used in artificial snowmaking. Instead of the tower configuration described in Alternative 1, this method would utilize a series of portable, ground-based blowers that would use compressed air to spray piped Salton Sea water up into the air and into the evaporation pond, rather than dropping it from towers.

Common Actions

Common actions have been developed to further address the goals of wildlife maintenance and enhancement, restoration of recreational uses, maintenance of the sport fishery, and identification of economic development opportunities. The common actions would be included with each alternative except No Action and could be implemented as early as 2003. Pilot projects are planned for each common action to finalize the specifications of each action and test its effectiveness. The proposed common actions are as follows:

- **Fish Harvesting—**Harvesting tilapia is being considered as a method to reduce the internal nutrient load and fish population densities within the Salton Sea. In addition to reducing nutrient loads, reducing tilapia densities is expected to provide a healthier environment for the fishery and could improve the health of the tilapia population. Boat dock facilities and a processing plant would be located at one of several sites along the shore, including the Salton Sea Test Base or on Torres Martinez Indian Reservation lands.
- **Improved Recreational Facilities—**The public boat ramps and access roads around the Salton Sea would be repaired to enhance their usefulness. Some channelization may be required to provide deeper water for boats to improve access to the Sea.
- **Shoreline Cleanup—**A shoreline cleanup program would consist of removing dead fish and other debris from the water surface and the shoreline. Removing the fish would reduce odors and nutrients from the Sea. The Sea cleanup operation would use skimmer barges to retrieve fish floating on the water surface. In addition, beach cleaning equipment, involving a conveyor system that rakes the beach, would be used to maintain the shoreline.
- **Integrated Wildlife Disease Program—**This program would include an integrated, multi-agency effort involving the National Wildlife Health Center of the US Geological Survey (USGS), the US Fish and Wildlife Service (USFWS), the Salton Sea Authority, and the California Department of Fish and Game

(CDFG). The program would include field technician-level support for on-site methodical monitoring of the Sea for wildlife die-offs, response assistance, biological sample collection, and scientific information compilation relative to wildlife mortality at the Sea.

- **Long-term Management Strategy**—The long-term management strategy would define activity coordination, project operational responsibilities, scientific research and monitoring responsibilities, and resource protection and management. The plan would be based on the concept that management is adaptable, given the recognized unknowns that exist in the Salton Sea ecosystem and the need for operational flexibility to respond to future monitoring and research findings and varying resource conditions. Physical and economical conditions would be considered in any proposed modification to project operation or implementation of any additional restoration measures. The plan would be designed to strengthen the restoration effort and to better meet the purpose and need of the project.
- **Strategic Science Plan**—This strategic science plan would allow managers to adapt restoration actions to future ecological needs and assure scientific evaluation is an integral part of adaptive management. The strategic science plan would include conceptual modeling, monitoring to evaluate the success of restoration actions, quantitative modeling, focused investigations to fill in key information gaps, technical assistance to involve time-responsive short-term needs, and data management.

Other Features

As shown in Table ES-1, several features are being considered to enhance the performance of alternatives over the range of the future inflow scenarios under consideration. In most cases, these features would not be implemented unless inflows to the Sea are reduced in the future. These features are as follows:

- **North Wetland Habitat**— Reduced annual inflows to the Sea would threaten the important island and snag habitat currently used by wildlife in the northern portion of the Sea. This area provides the largest expanse of snag habitat at the Sea along with low island habitat. The north wetland habitat area would be constructed to preserve these existing values in the area as well as allow adaptive management of a freshwater/Salton Sea water interface to enhance habitat values.
- **Pupfish Pond**—This pond would be included in Alternatives 1 and 4 to maintain connectivity of drains for pupfish. To maintain this habitat and connectivity between the drains in this area, additional dikes would be constructed from the north and south ends of the south evaporation pond extending to the shoreline, effectively creating a nearshore habitat protection pond between the shore and the evaporation pond. Significant snag habitat on the west side of the New River and the habitat around the mouth of San Felipe Creek would also be protected within this pond.

- **Displacement Dike**—This dike would be constructed in the southern portion of the Sea under the reduced inflow scenarios. It is designed to essentially reduce the total area of the Sea, effectively displacing enough water to maintain elevations if annual inflows are reduced. The dike would reduce the surface area of the Sea by 13,500 acres. The Sea water in the area behind the dike would initially evaporate and thereafter could alternately be dry or wet depending on the season.
- **Flood Flows**—This action would involve augmenting inflow to the Sea by using a portion of the total flood flows available from the Colorado River. Colorado River flood flows are generally available approximately every three to seven years. The maximum amount of flood flows considered for diversion to the Sea over the planning horizon represents about 10 percent of the expected flood flow releases. Flood flows are beyond any entitled or surplus water dedicated to water users in the Basin states and in excess of flows needed to meet treaty obligations to Mexico.

Phase 2 Export and Import Actions

Phase 2 actions would export water from or import water to the Salton Sea if conditions of the Sea warranted such action in the future. These actions have been developed on a programmatic level; thus, descriptions provided represent typical alignments and pipeline details that could be used. Phase 2 actions may or may not be needed based on the efficiency of Phase 1 actions and reductions in inflow from water conservation and other diversions. Because none of these Phase 2 actions would be constructed for at least 15 to 30 years, detailed analyses of potential environmental consequences are not currently feasible. The joint lead agencies plan to continue to develop and refine these actions. Once specifics are determined, additional environmental analysis would be performed.

Export Actions—Phase 2 export options include:

- Expanded EES
- Export to the Gulf of California
- Export to the Pacific Ocean
- Export to Palen Dry Lakebed

Import through Yuma, AZ—This action would involve the import of water that originates as a brine stream from the proposed CASI, through Yuma to the Salton Sea. The CASI is designed to transport brackish water by gravity from the Tucson and Phoenix areas to Yuma. This water would be less saline, at approximately 4,400 mg/L, than the existing Salton Sea water and would help reduce salinity and stabilize elevation if annual inflows are significantly reduced. CASI water is expected to be available in approximately 25 years, with the current plans for its disposal including discharge to the Gulf of California. Approximately 304,800 af/yr are estimated to become available for diversion to the Salton Sea. This amount of CASI water could be conveyed continuously at approximately 420 cfs through a newly constructed canal to parallel the existing, All-American Canal.

Cumulative Impacts

Twenty-six projects in the region have been identified that could potentially have cumulative effects when combined with the Salton Sea restoration project. The greatest probability that any given project would have cumulative effects would occur if the project could potentially cause some change to the future inflows to the Sea. With the competing demands for water in California, it is most likely that the cumulative effects of almost any combination of these projects would be a future reduction of inflows to the Sea. Rather than attempt to forecast the individual effects of each project, two reduced inflow scenarios have been evaluated for all alternatives including the No Action Alternative. The environmental effects of both reduced inflow scenarios have been discussed for each alternative. These discussions in essence address the cumulative effects of any number of projects that could cause reductions to the inflows to the Sea. In addition, a discussion of any other specific cumulative effects is included near the end of each resource section in chapter 4. Environmental documentation prepared for any of the projects considered in the cumulative analysis is expected to include any specific impacts that project would have on the Salton Sea.

Environmental Consequences

All alternatives would provide long-term beneficial effects to the aquatic and the avian habitat at the Sea. Other benefits could include socioeconomic recovery of the area. Some potentially significant adverse impacts also have been identified. Probably the greatest of these effects would be the visual impacts and loss of desert habitat associated with the EES facilities that are part of alternatives 2, 3, 4, and 5. In addition, for the evaporation ponds that are part of alternatives 1, 4, and 5, concerns include release of brine material in the event of a dike failure, possible effects on birds that try to feed on fish in the highly saline ponds, Native American resource impacts, and the ultimate fate of salts that accumulate in the ponds. The most substantive environmental effects expected to be associated with each alternative are as follows:

No Action

- The existing fishery will deteriorate and disappear
- Bird species would be threatened by loss of fisheries
- A significant drop in Sea elevation and decrease in surface area could occur if inflows to the Sea decrease in the future
- Local economic conditions and recreational opportunities would continue to decline

Alternative 1

- Long-term benefits compared to No Action for fisheries and bird species
- Beneficial effects to recreation and the local economy from restoration activities

- Fugitive dust problems could occur during construction
- Temporary disturbance of fisheries would occur during construction
- Visual changes due to alterations in the landscape in the vicinity of ponds and dike structures
- Potential traffic impacts (delays) between material borrow site and the Sea during construction activities
- Possible disturbance of cultural and Native American resources
- Additional effects associated with export options could occur during Phase 2

Alternative 2 & 3

- Long-term benefits compared to No Action for fisheries and bird species
- Beneficial effects to recreation and the local economy from restoration activities
- Fugitive dust problems could occur during construction
- Possible disturbance of cultural and Native American resources
- Loss of desert habitat and possible salt drift effects at and near EES site and associated potentially significant impacts to special status species
- Visual changes due to alterations in the landscape in the vicinity of ponds, dike structures, and the EES towers
- Potential adverse impacts to migrating birds due to tower configuration and height

Alternative 4

- Long-term benefits compared to No Action for fisheries and bird species
- Beneficial effects to recreation and the local economy from restoration activities
- Fugitive dust problems could occur during construction
- Potential traffic impacts (delays) between material borrow site and the Sea during construction activities
- Loss of desert habitat and possible salt drift effects at and near EES site
- Possible disturbance of cultural and Native American resources
- Visual changes due to alterations in the landscape in the vicinity of ponds, dike structures, and the EES towers
- Potential adverse impacts to migrating birds due to tower configuration and height

Alternative 5

- Long-term benefits compared to No Action for fisheries and bird species

- Beneficial effects to recreation and the local economy from restoration activities
- Fugitive dust problems could occur during construction
- Temporary disturbance of fisheries would occur during construction
- Potential noise impacts from ground-based EES
- Potential traffic impacts (delays) between material borrow site and the Sea during construction activities
- Possible disturbance of cultural and Native American resources
- Visual changes due to alterations in the landscape in the vicinity of ponds, dike structures, and the ground-based EES spray system
- Additional effects associated with export options could occur during Phase 2

CHAPTER 1
INTRODUCTION

1.1 SALTON SEA RESTORATION PROJECT BACKGROUND

Salton Sea Facts

- Located south of Palm Springs in Imperial and Riverside counties
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The Salton Sea is an excessively salty, eutrophic (nutrient-rich) lake in a closed basin. The Sea exists primarily due to continued agricultural drainage from the Imperial, Coachella, and Mexicali valleys and smaller contributions from municipal effluent and stormwater runoff. A eutrophic lake is enriched in dissolved nutrients that stimulate the growth of aquatic life, usually resulting in the reduction of dissolved oxygen. The Sea has a productive sport fishery and provides important migratory and resident bird habitat within the Pacific Flyway. Seasonal bird use includes millions of birds, and approximately 400 bird species have been recorded at the Salton Sea and adjacent areas. Several endangered species, including the desert pupfish, brown pelican, and the Yuma clapper rail, inhabit the Salton Sea or adjacent habitats.

The Salton Sea is under stress from increasing salinity, nutrient loading, oxygen depletion, and temperature fluctuations that may be threatening the reproductive ability of some biota, particularly sportfish species, and also causing additional ecosystem health problems. There are indications that the deteriorating environmental conditions may be contributing to the prominence of avian disease at the Sea. If these trends continue, the Sea will continue to deteriorate.

In addition to impacts on biota, the fluctuations of the Sea's level and deteriorating water quality may be limiting the potential for economic development that depends on the Sea. A long-term rise in the Sea level along with seasonal fluctuations has contributed to alternately flooding and stranding of facilities for lake-dependent activities, including camping and boat launching. Continued increases along with seasonal or short-term fluctuations in water elevation also may adversely affect nesting success for some avian species.

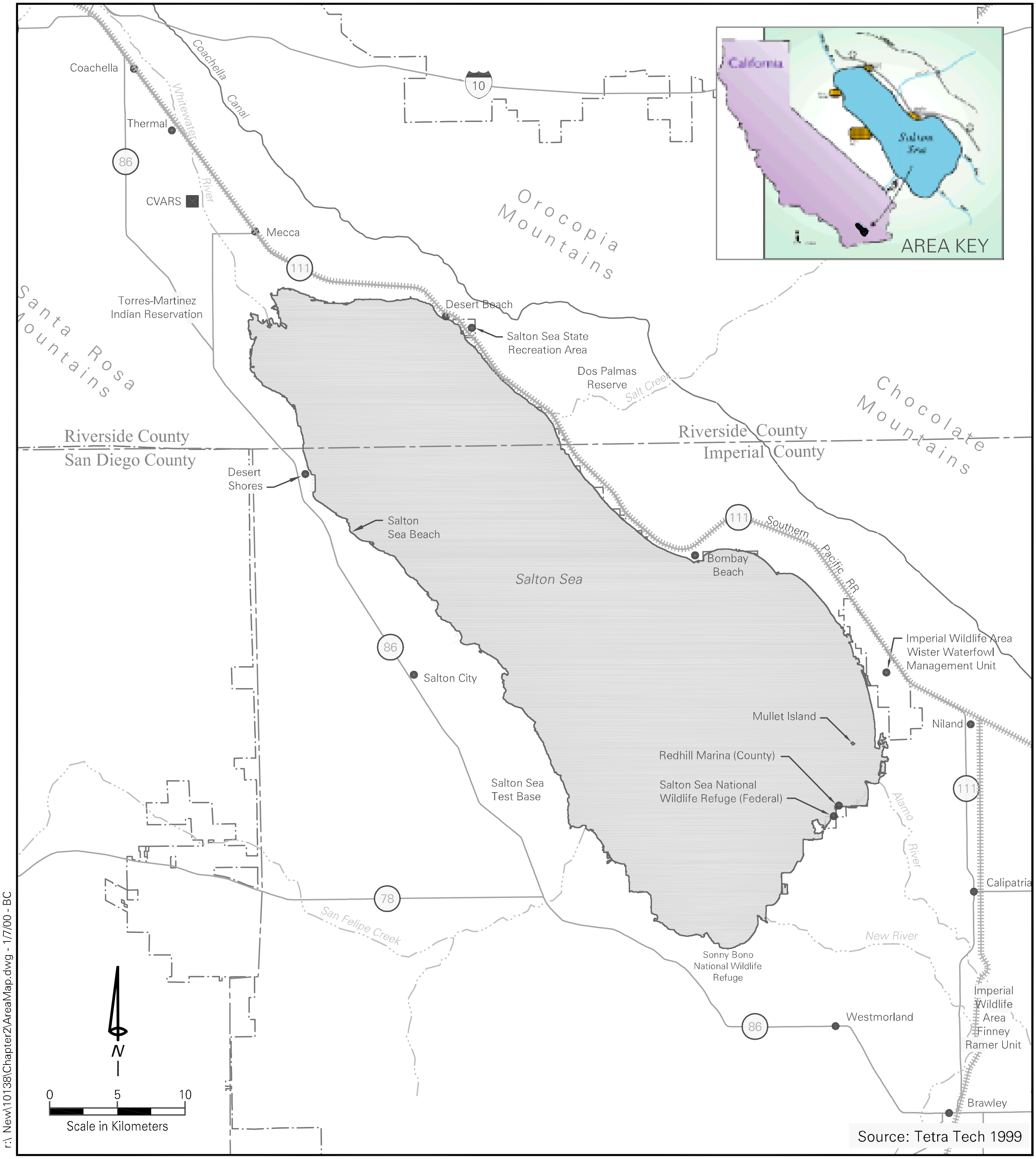
Congress passed Public Law (PL) 102-575 in 1992. The law directs the Secretary of the Interior to "conduct a research project for the development of a method or combination of methods to reduce and control salinity, provide endangered species habitat, enhance fisheries, and protect human recreational values . . . in the area of the Salton Sea." The Salton Sea Reclamation Act of 1998 (PL 105-372) was passed to further the restoration process. PL 105-372 directs the Secretary of Interior to "complete all studies, including, but not limited to environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea as a reservoir for irrigation drainage and: (i) reduce and stabilize the overall salinity of the Salton Sea; (ii) stabilize the surface elevation of the Salton Sea; (iii) reclaim, in the long term, healthy fish and wildlife resources and their habitats; and (iv) enhance the potential for recreational uses and economic developments of the Salton Sea."

Developing the Salton Sea Restoration Project requires compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). To satisfy both NEPA and CEQA requirements, the US Department of the Interior Bureau of Reclamation (Reclamation) and the Salton Sea Authority (Authority), as the lead agencies in cooperation with a number of interested agencies, have prepared this joint draft environmental impact statement/environmental impact report (EIS/EIR). Founded in 1993, the Authority is a joint powers authority formed by the Coachella Valley Water District, Imperial County, the Imperial Irrigation District, and Riverside County. This joint EIS/EIR document describes the existing environmental and socioeconomic conditions near the Salton Sea, and the environmental consequences of the project alternatives, including no action.

1.2 SALTON SEA PROJECT STUDY AREA

The Salton Sea is the largest inland body of water in California. It is in the southeastern corner of California and spans Riverside and Imperial counties. The closest cities include Palm Springs, Indio, Brawley and El Centro. The area is largely agricultural, although the Sea offers opportunities for recreation, and a few residential communities dot the shoreline. Geothermal exploration was initiated in 1957, and several active plants operate in Imperial County near Niland. The Salton Sea State Recreational Area occupies the northeast shoreline, the state waterfowl area (Wister Unit) is in the southeast, and the Sonny Bono National Wildlife Refuge, operated by the US Fish and Wildlife Service (USFWS), spans the southern shoreline of the Sea.

The study area is located primarily in the Colorado Desert ecosystem, an area with local mean annual precipitation of less than 3 inches per year (yr) that has been disturbed by human use. Vegetation types include desert scrub, riparian cottonwood/willow, freshwater marsh, and agricultural lands as well as invasive exotics such as salt cedar. Mountains, including the Santa Rosa Range to the west, Orocopia Mountains to the north, and the Chocolate Mountains to the east, surround the closed basin on three sides. The Salton Sea area is shown on Figure 1.2-1.



Location of Federal, State, County, and University Facilities in the Vicinity of the Salton Sea.

Legend

■ CVARS, Coachella Valley Agricultural Research Station (University of California- Riverside)

Salton Sea Area

Salton Sea, California

Figure 1.2-1

The Salton Sea is a terminal hypersaline lake. It occupies a below sea level desert basin known as the Salton Sink, which has experienced multiple episodes of flooding and drying due to changes in the course of the Colorado River since prehistoric times. Intermittently, the Salton Sink has contained an ancient lake even more extensive than today's Salton Sea. The evidence for Lake Cahuilla, as it has been named, are its remnant shorelines, visible along the base of the Santa Rosa Mountains. The basin received floodwaters from the Colorado River on multiple occasions, including in 1849, 1862, 1891, and 1900 (Koenig 1971). The frequency with which this basin has been flooded in recent history increases the likelihood of a long history of use by migratory birds. Cultural sites near the present and historic shorelines attest to the use of these temporary lakes by native people. Between episodic fillings evaporation reduced the lake level.

During the early 1900s, water for irrigation was first brought into the area through a series of ditches from the Colorado River. In 1905, excessive flows in the Colorado River breached an irrigation control structure causing virtually the entire river flow to drain into the Salton Sink. The flow was not contained for the next 16 months, leaving behind the current Salton Sea. After the flooding, the level of the sea receded to about -250 ft mean sea level (msl) by 1925. As agricultural efforts increased, and drainage discharged to the Sea, the level has undergone seasonal fluctuations with a long-term rising trend.

The Salton Sea is currently maintained by agricultural runoff, and to a lesser extent by municipal effluent and stormwater that flows into the Sea through rivers and creeks in the Imperial, Coachella, and Mexicali valleys. The northern portion of the study area is drained by the Whitewater River and its tributaries, reaching the northern end of the Salton Sea within the Coachella Valley not far from the town of Mecca. Salt Creek drains the southern slope of the Orocopia Mountains and the northern end of the Chocolate Mountains, entering the northeast portion of the Sea within the state park boundary. The most important western drainage is San Felipe Creek, with headwaters near Julian, about 50 miles west of the Salton Sea. The New and Alamo rivers drain the Imperial Valley and to a lesser extent, the Mexicali Valley to the south; together these two rivers account for most of the flow into the Salton Sea. Annual Sea inflow is approximately 1.36 million-acre-feet per year (maf/yr). (Figure 1.2-1).

Because the Sea has no outlet, and evaporation provides the only discharge, constituents in the inflow become concentrated over time. Accumulation and concentration of salts, nutrients, organic compounds, and other constituents that can be detrimental at higher concentrations have had harmful effects on the ecosystem and recreational use at the Sea.

The Sea is a highly eutrophic ecosystem that includes a productive sport fishery. The Sea and wetlands along its shoreline are a critical part of the Pacific Flyway, providing habitat and seasonal refuge to millions of birds representing hundreds of species. Several endangered species, including the desert pupfish, the brown pelican, and the Yuma clapper rail, inhabit the Salton Sea or adjacent habitats.

The Salton Sea Restoration Project has been divided into two phases. The primary study area for impact analysis of Phase 1 actions includes the Sea itself and a zone extending roughly five miles from the shoreline to include lands identified for project alternatives. The study area also includes the channels of the All American Canal and the Coachella Branch identified as conduits for flood flows and the Colorado River downstream of the All American Canal to the Sea of Cortez. Additional areas that are relevant to specific environmental resources are also included. Phase 2 actions extend the analysis study area to include pipeline corridors north to the San Gorgonio Pass, west to the Pacific Ocean, south into Mexico to the Gulf of California, east to Yuma, Arizona, and northeast to the Palen dry lakebed. However, these areas are analyzed in less detail and on a programmatic basis. The restoration project focus is on the Sea itself.

1.3 PURPOSE AND NEED FOR THE SALTON SEA RESTORATION PROJECT

The purpose and need for the Salton Sea Restoration Project is to maintain and restore ecological and socioeconomic values of the Salton Sea to the local and regional human community and to the biological resources dependent upon the Sea. These requirements are reflected in the directives of PL 105-372. The purpose and need will be met by implementing a project that satisfies the goals and objectives discussed in the next section of this EIS/EIR. The project is intended to have ecological, recreational, and economic benefits.

Increasing salinity in the Sea, which is currently about 44,000 milligrams per liter (mg/L), already may be threatening the reproductive ability of some parts of the biota. If the current trend of increasing salinity continues, sport fish in the Salton Sea will be eliminated over the next few decades. Therefore, controlling salinity is a critical need if the Salton Sea is to support biodiversity similar to what currently exists. In addition, the Sea is located along the Pacific Flyway, the most western of the major migration corridors for waterfowl and other species in the United States. Therefore, the fish populations in the Sea are an important food source to picivorous (fish-eating) birds that use the Pacific Flyway. Other issues include unacceptable levels of bird and fish die-offs, high nutrient loading to irrigation drains leading to the Sea, and perceptions and concerns about pollution from selenium, other chemicals, and microbes. All of these issues also must be addressed to benefit the fish and wildlife resources and habitats of the Salton Sea and to meet the directives of Congress.

Additional benefits that may result from the restoration project include enhanced recreational opportunities and economic development. Long-term shifts in water levels have alternately flooded and stranded such facilities as campgrounds, boat launching ramps, and resorts. Control of water surface elevation within an acceptable range could stimulate future investments in shoreline development, in addition to stimulating biological values from sustaining wildlife habitat. The long-term monitoring and management strategies that are a part of the restoration program will seek to balance the possible conflicts between shoreline development and maintenance of wildlife habitat.

Units of Measure

- Salinity is commonly measured in milligrams per liter (mg/L) or parts per million (ppm). One ppm approximately equals one mg/L
- Measured at Imperial Dam near Yuma, AZ, the Colorado River contains about 2,000 pounds of salt per acre foot or about 725 mg/L of salts
- An acre-foot equals about 326,000 gallons or enough water to cover an acre of land (about one football field) one foot deep
- A typical California household of 4 uses between 1/2 and 1 acre-foot per year for indoor and outdoor use

The biological resources of the Sea and its value to society are linked through the Sea's avian diversity, the productivity of its sport fishery, and its attraction as a recreational destination. With approximately 400 species of birds reported in the area, the Salton Sea area is one of the greatest areas of avian biodiversity in the nation. The sport fishery is the most productive of any California inland waterbody, and the large biomass of fish is the food base for the large number of fish-eating birds at the Sea.

Because of significant losses of interior wetlands, including more than 90 percent of those within California, the Sea serves an important role in the international, regional, and local conservation of migratory birds. Significant proportions of some populations have become dependant on the Sea. For some of these species there may be no alternatives because of bioenergetics (the energy transformation and exchange between living organisms and their environment) associated with food availability (quantity and quality), travel distances between migration stopover points, and body condition relative to breeding success.

Recreational use of the Sea includes waterfowl hunting, boating, fishing, bird watching, and photography. Waterfowl hunting is a long-standing tradition at the Salton Sea and even during the 1920s attracted hunters from Long Beach, Los Angeles, and other areas. The popularity of bird watching at the Sea has increased in response to the diversity of the Sea's avifauna and has resulted in the international bird festival becoming an annual event. An evaluation of the economic impacts associated with bird watching at the Sea disclosed a substantial economic benefit to the local communities and businesses.

The sport fishery of the Sea is focused primarily on orange-mouth corvina (*Cynoscion xanthulus*), tilapia (*Oreochromis mossambicus* and other species and hybrids), bairdiella or Gulf croaker (*Bairdiella icistia*), and sargo (*Anisotremus davidsoni*), All of these are introduced species (see Section 3.6). Tilapia are the dominant component of the fish biomass and are a major food item for pelicans (*Pelicanus* sp.) and other fish-eating birds at the Sea. Declining environmental quality of the Sea and the selenium health advisory, rather than declining fish populations, are believed to be the main reasons for the drop in recreational fishing. Fish populations remain high; however, their future is threatened by increasing salinity.

On February 12, 1955, the Salton Sea State Park (now the Salton Sea Recreation Area) was dedicated, and at the time was the second largest park in the state. Visitor use to the late 1970s reflected the popularity of this area, and exceeded visitation at Yosemite National Park. Salton Sea Recreation Area visitation was 250,000 people during fiscal year 1997-1998. Improvements to the general environmental conditions at the Sea could significantly increase visitor use above the current levels. Factors that will stimulate human visitation, in combination with the scenic beauty of the area and more than 300 days of sunny weather each year, include projected population growth within the Coachella and Imperial valleys, the relative proximity of this waterbody to approximately six percent of the US population, and increased wildlife values of the Sea.

Despite the attributes described above for the Salton Sea, environmental degradation is challenging the ability of the Sea to sustain the biological components that society values. The signs of environmental degradation are manifest by frequent large-scale fish and bird die-offs. The magnitude of large-scale fish die-offs is in the hundreds of thousands to millions of tilapia and occasionally bairdiella per occurrence. The large-scale bird die-offs are killing substantial segments of some of the migratory bird populations at the Sea. Examples include the 1992 loss of approximately 150,000 eared grebes. This was about 3.5 to 4 percent of the North American population of this species. The cause of that event remains essentially unknown. During 1996 an unprecedented outbreak of type C avian botulism in fish-eating birds killed more than 15,000 birds. Approximately 10 to 20 percent of the western population of white pelicans died during this event. More than 1,000 California brown pelicans also were affected, making this the largest single loss from disease of an endangered species. These events were followed by the first occurrence of Newcastle disease in wild birds west of the Rocky Mountains. Virtually the entire production of double-crested cormorants hatched on Mullet Island died from Newcastle disease during 1997. A similar outbreak assumed to be Newcastle disease occurred in 1998.

These and other diseases diagnosed as causes of bird mortality at the Sea present an unusual array of recurring die-offs for a single location. Multiple causes of mortality have also been diagnosed for fish dying at the Sea. Disease is an outcome rather than a cause, and environmental factors are often the major reason for diseases. A logical conclusion from the variety, frequency, and magnitude of wildlife losses at the Salton Sea is that the Sea is exhibiting severe environmental stress. Fundamental needs for reducing that stress are identifying the causes, selecting remedial actions, and evaluating those actions to assess probable outcomes prior to implementation.

1.4 SALTON SEA RESTORATION PROJECT GOALS AND OBJECTIVES

Prior to implementing the NEPA/CEQA process, the Salton Sea Authority and the Bureau of Reclamation, working jointly with stakeholders and members of the public, developed five goal statements. The goal statements are consistent with the direction contained in PL 105-372, address the underlying purpose and need for the project, and provide guidance for developing project alternatives. The five goals of the Salton Sea Restoration Project are as follows:

1. Maintain the Sea as a repository of agricultural drainage;
2. Provide a safe, productive environment at the Sea for resident and migratory birds and endangered species;
3. Restore recreational uses at the Sea;
4. Maintain a viable sport fishery at the Sea; and
5. Enhance the Sea to provide economic development opportunities.

In order to measure the effectiveness of any actions designed and implemented to achieve the five project goals, objectives were developed in cooperation with stakeholders to further define each goal. In many cases, objectives overlap and result in mutual benefits. The goals and objectives have been used to guide the development of alternatives analyzed in this EIS/EIR. These same objectives ultimately will be used to guide efforts to monitor and evaluate the effectiveness of any restoration actions that are implemented. The objectives could also be adjusted through an adaptive management process, which will be part of the long-term management strategy discussed in chapter 2.

1.4.1 Goal 1—Maintain the Sea as a Repository of Agricultural Drainage

Agriculture constitutes the major economic base in Imperial County and a significant part of the economy in eastern Riverside County. The Imperial and Coachella valleys provide an important source of vegetables and other produce to the nation, particularly in the winter. Because of the importance of drainage to maintaining the agricultural economy and the lack of an alternative disposal site, the Sea serves as the repository for agricultural drainage. In 1924 and again in 1928, President Coolidge issued Executive Orders setting aside federal land within the basin below –220 mean Sea level as a public water reserve for irrigation drainage. In 1968, the state of California declared by statute that the primary use of the Sea is for collecting agricultural drainwater, seepage, leaching, and control waters. Agriculture in its present form relies on the ability to discharge drainage into the Sea. Thus, the continued use of the Salton Sea as a repository for agricultural drainage is a fundamental component of the Salton Sea Restoration Project. It is both a goal defined by the joint lead agencies for the NEPA/CEQA effort and a basic assumption contained within PL 105-372. The Salton Sea will not exist as a major waterbody without agricultural drainage; therefore, the availability of the Sea as a drainage repository is essential for achieving all other project goals. Specific objectives that will be used to ensure that agricultural uses are maintained are as follows:

Objectives

- Stabilize water surface elevation within a range allowing for climate and drainage-induced annual fluctuations (preferably +/- –230 msl); and
- Maintain agricultural drainage accessibility to the Sea.

1.4.2 Goal 2—Provide a Safe, Productive Environment at the Sea for Resident and Migratory Birds and Endangered Species

A number of avian species and fish species are highly dependent on a healthy Salton Sea ecosystem. These species include threatened and endangered species (including both avian and fish species), federal species of management concern, and trust species of migratory birds. Additionally, various shorebirds, marsh birds, gulls, terns, and passerines contribute to the biodiversity at the Sea and within the watershed. Specific objectives that will be used to ensure that this environmental goal is attained are as follows:

Objectives **Typical Species Affected**

• Enhance aquatic marsh habitat	Yuma clapper rail
• Maintain open-water habitat and a foodbase for fish-eating birds	California brown pelican, American white pelican, great blue heron
• Protect/provide appropriate habitat for roosting and nesting	double-crested cormorant, great blue heron
• Maintain a broad array of avian foraging habitat	black-necked stilt, ruddy duck, eared grebe
• Enhance stability of shoreline pools and creeks	desert pupfish, western snowy plover
• Sustain water levels suitable for desert pupfish	desert pupfish
• Reduce losses from disease	pelicans, eared grebe

1.4.3 Goal 3—Restore Recreational Uses at the Sea

The Salton Sea is rated as Class I recreational water. Class I waters are considered to be suitable for recreational uses that include body contact. While recreation continues to draw visitors to the Salton Sea, recreational use in the past was higher and more varied, with visitors camping, picnicking, and participating in numerous water sports, such as boat racing, water skiing, and swimming. The availability of these different recreational opportunities at the Sea attracted visitors to the region. Over the years, increasing surface water elevations flooded recreational facilities along the shoreline. In addition, decreasing water quality and the increasing public perceptions of potential health risks at the Sea led to visitor decline. A fish consumption health advisory, reports of pathogens being transported to the Sea via the New River, algal blooms and the attendant odors resulting from their decay, and large-scale fish and bird die-offs may have led to a decrease in visitation and particularly water/body contact recreational uses. Today, the Sea remains extremely popular for bird watching, but, while opportunities are plentiful for camping and fishing, use has markedly declined since the early 1980s. Specific objectives that will be used to restore recreational uses are as follows:

Objectives

- Stabilize water surface elevation within a range, allowing for climate and drainage-induced annual fluctuations (preferably +/- –230 msl);
- Improve access to the Sea and recreational quality of shoreline;
- Address selenium health advisories on eating fish;
- Reduce objectionable odors;
- Reduce occurrence of algal blooms; and
- Maintain State Class I recreational quality status.

1.4.4 Goal 4—Maintain a Viable Sport Fishery at the Sea

The Salton Sea became widely known for its sport fishery following the successful introduction by the California Department of Fish and Game (CDFG) of several species from the Gulf of California. The orange-mouth corvina, a fish that can weigh in excess of 30 pounds, is the most prized of the Sea's sport fish. Tilapia, an exotic species of much smaller size, also has become established as the most dominant and overly abundant and the most easily caught species at the Sea. A highly valued fish for human consumption, tilapia is most often associated with massive fish die-offs at the Sea. In addition, bairdiella, sargo and several other species historically added to sport fishing opportunities. Specific objectives that will be pursued to ensure that the sport fishery goal is attained are as follows:

Objectives

- Maintain a healthy habitat for orange-mouth corvina, tilapia, bairdiella, and sargo;
- Reduce and maintain salinity at 40,000 mg/L or lower;
- Reduce the occurrence of large-scale fish die-offs.

1.4.5 Goal 5—Enhance the Sea to Provide Economic Development Opportunities

A healthy Salton Sea ecosystem with its associated bird life, sport fishing, and the surrounding natural beauty of the area are fundamental attractions for people to visit and settle at the Sea. This human use provides a foundation for economic development that extends beyond the productive agriculture of the area. In addition, stabilizing the Sea's surface elevation is important for shoreline development. Water elevation and salinity control will play a significant role in increasing opportunities for economic development around the Sea. Specific objectives for enhancing economic development opportunities are as follows:

Objectives

- Reduce objectionable odors;
- Implement objectives for sport fisheries;
- Implement objectives for fish and wildlife; and
- Implement and maintain a clean shoreline.

1.5 SCIENTIFIC FOUNDATION OF THE SALTON SEA RESTORATION PROJECT

Overwhelming mortality of wildlife, including endangered species, has focussed national attention on the Salton Sea and the need for aggressive actions to improve the environmental quality of this important waterbody. The Secretary of Interior, in collaboration with other agency stakeholders in the Salton Sea, established a supplementary Salton Sea Science Subcommittee (SSC), whose role is to augment scientific information available for evaluations associated with the Salton Sea Restoration Project (Project) EIS/EIR. The reason for establishing the Science

Subcommittee is founded in the natural resources importance and the many uncertainties associated with the existing and future conditions.

This interagency, interdisciplinary SSC is administratively responsible to the Research Management Committee (RMC), high level representatives from primary stakeholder agencies. All scientific evaluations are done at the SSC level. The RMC acts on SSC recommendations for funding science needs identified by the SSC and for awarding science projects evaluated by the SSC. The RMC forwards recommended projects to the Salton Sea Authority for funding. These projects are submitted by the scientific community in response to solicitations issued by the SSC. The charter for the RMC and SSC is provided on Reclamation's website at www.lc.usbr.gov. The compositions for the RMC and SSC are shown in sections 8.5 and 8.6 of this EIS/EIR.

The primary purpose for this science component is to provide a sound scientific foundation on which to base management judgments on various alternatives to achieve project goals. To arrive at this point, the following tasks were accomplished:

- Gathering, synthesizing, and evaluating existing scientific information relative to the Salton Sea ecosystem;
- Identifying priority data gaps and facilitating investigations for obtaining that data;
- Completing focused scientific evaluations of potential environmental impacts from proposed project alternatives and management actions; and
- Developing a strategic science plan to guide the long-term integration of science within the project.

It is recognized that restoration of the Salton Sea requires a long-term effort, that science needs for the immediate NEPA/CEQA evaluations differ somewhat from the long-term needs, and that a phased approach is needed for the science effort. A Strategic Science Plan (SSP) to guide the long-term integration of science within the project is described as a common action in Section 2.5.6 and is discussed further in a companion document to this NEPA/CEQA evaluation. The SSP builds upon the foundation provided by the SSC process and provides a blueprint for the science process, functions, and administrative structure, which are needed to sustain a long-term science component of the adaptive management approach.

1.6 Level of Detail and Tiering of Information Under NEPA and CEQA

NEPA regulations provide for tiering documents to allow environmental analyses to proceed at appropriate phases when developing alternatives. Section 1508.28 (b) of the Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (CEQ 1979) provides guidance that tiering is appropriate when the sequence of statements or analyses is " . . . from an environmental impact statement on a specific action at an early stage (such as need and site selection) to a supplement (which is preferred) or a subsequent statement or analysis at a later stage (such as environmental mitigation). Tiering in such cases is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe."

Similar guidance is provided in the State Guidelines and the Salton Sea Authority's Local Guidelines (Authority 1999) for Implementing CEQA, which provide for both tiered and staged EIRs. In CEQA terms, staging would be similar to tiering, as discussed above. Section 8.06 of the CEQA guidelines states that "A staged EIR should evaluate a proposal in light of current and contemplated plans and produce an informed estimate of the environmental consequences of the entire project."

Salton Sea restoration alternatives have been conceived in two separate but dependent phases. Phase 1 alternatives will begin to stabilize and reverse current trends of degradation of the Sea. These alternatives have been developed and analyzed in sufficient detail to support implementation decisions, following completion and certification of the final EIS/EIR and all required permits. These actions, designed to begin the restoration process, have a design life of approximately 30 years and could have a long-term utility with or without the implementation of Phase 2 alternatives. The actions were designed to function at current and reduced inflows, as directed by PL 105-372. The lead agencies assumed that potential reductions through various means could equal 300,000 acre-feet per year by year 30 and, as directed by the law, considered options for actions that "augmented flows of water into the Salton Sea." Implementing Phase 2 actions will extend efforts initiated by Phase 1 actions and the useful life of the project to at least 100 years. In particular, the focus of Phase 2 alternatives includes long-term disposition of salts removed from the Sea, as well as importation of water to compensate for potential long-term reductions of average inflows to the Sea. Phase 2 alternatives also will extend the Phase 1 efforts to address disease management, nutrient loading, habitat enhancement, and recreation and to function as a continuum of the long-term restoration process. Phase 2 alternatives have been developed and analyzed generically due to the distant time frame for implementation and the uncertainties inherent in evaluating actions not scheduled to occur for many years. In accordance with the guidance discussed above, the analysis is intended to evaluate Phase 2 alternatives to "produce an informed estimate of the environmental consequences of the entire project." Subsequent NEPA/CEQA documentation will be required before final decisions could be made on Phase 2 alternatives.

The restoration project will include a long-term management strategy, as discussed in Chapter 2 of this EIS/EIR, to ensure that Phase 1 actions will be appropriately linked to any possible or necessary Phase 2 actions. This strategy will include monitoring to identify and enable corrective actions to be implemented if conditions change or if it appears that project objectives will not be achieved or maintained. It is possible to attain a higher level of assurance that the objectives will be achieved and maintained if the corrective actions are allowed to flexibly adapt to changing, sometimes unforeseeable, future conditions. This objective-oriented management method is sometimes referred to as adaptive management. The long-term management strategy will be developed through coordination with the various agencies charged with regulating the implementation of the alternatives and monitoring the restoration of the Salton Sea.

1.7 CONTENTS AND ORGANIZATION OF THIS EIS/EIR

1.7.1 Issue Identification Through the Public Scoping Process

The identification of issues to be addressed in the EIS/EIR included internal agency review and analysis and the public scoping process. The purpose of scoping is to encourage the public and government agencies to help identify issues and topics that an EIS/EIR should address. Requests for comments and notices of public scoping meetings were published as a Notice of Intent in the Federal Register and filed as a Notice of Preparation with the State of California Clearinghouse on June 26, 1998. Reclamation and the Authority held public scoping meetings on July 15, 16, and 17, 1998, at Desert Shores, La Quinta, and El Centro, respectively. Information on the proposed Salton Sea Restoration Project was presented, and the public was invited to raise issues and questions to be considered in the draft EIS/EIR. Additional public workshops were held October 7, 8, and 9, 1998, in Desert Shores, El Centro, and San Diego for the public to comment, to pose questions, and to discuss the alternative screening process. Additional workshops were held during the refining stages of the alternative development process. Further discussion of the public involvement process is included in Chapter 8 of this document. In general, the concerns raised included the following:

- Water quality and quantity;
- Salinity increase;
- Contaminants and public health;
- Aesthetics, particularly odors and visual impacts;
- Long-term management goals;
- Wildlife;
- Agriculture;
- Economic development;
- Recreation;
- Elevation stabilization;
- International boundary issues;
- Cultural and Native American issues;
- Alternative development;
- Timeframe for initiating solutions; and
- Project financing;

All of these issues were considered in developing the content of this EIS/EIR and, where appropriate, are addressed within the individual resource sections of the document.

1.7.2 Main EIS/EIR Document

The organization of this EIS/EIR is consistent with federal and California guidelines for implementing NEPA and CEQA, respectively. This introductory chapter provides an overview of the project and its goals and objectives, along with a discussion of the purpose and need for the project. Chapter 2 describes the study region, alternative development process, the public scoping process, the alternatives retained for evaluation, the No Action Alternative, the alternative refinement process, and projects included in the cumulative impact analysis. Chapter 2 also provides a summary of the operational assumptions and regulatory framework of the EIS/EIR and includes a summary table comparing the environmental consequences of the project alternatives.

The main body of the EIS/EIR is in chapters 3 through 6, which contain descriptions of the affected environment and environmental consequences. Chapters 3 through 6 are organized as follows:

- **Chapter 3. Affected Environment/Existing Conditions**—Provides a general description of the physical environment and socioeconomic factors around the Sea that may be affected by the restoration project. More emphasis is placed on environmental factors that could be most affected by the project. The region of study is primarily limited to areas that would be affected by Phase 1 alternatives because the specific locations of most Phase 2 actions have not yet been determined.
- **Chapter 4. Environmental Consequences of Phase 1 Alternatives**—This chapter includes a discussion of the No Action Alternative and the direct and indirect effects of Phase 1 project actions. The primary focus of this chapter is the features of each Phase 1 actions that are different from one another as compared to common features that are addressed in the next chapter. This chapter includes descriptions of the criteria by which the significance of impacts of the alternatives have been assessed. For impacts judged to be potentially significant, reasonable mitigation measures or strategies are presented. Potentially significant unavoidable impacts also are identified.
- **Chapter 5. Environmental Consequences of Phase 1 Common Actions**—This chapter provides a description of the effects of Phase 1 common actions. The information contained in this chapter has been separated from Chapter 4 to avoid repetition in the discussion of the environmental consequences of actions that are essentially the same for all alternatives.
- **Chapter 6. Environmental Consequences of Phase 2 Actions**—Provides a description of the direct and indirect effects of Phase 2 actions. A discussion is included of the effects of no additional action in Phase 2 both without Phase 1 actions in-place and with Phase 1 actions. Where Phase 2 actions could have

effects outside the affected environment area discussed in Chapter 3, a brief discussion of the potentially affected environment is included. As discussed above, the potential environmental consequences of Phase 2 actions are discussed only in limited detail. These discussions, along with the more detailed information provided for Phase 1, are intended to assist in producing "an informed estimate of the environmental consequences of the entire project."

Chapters 3 through 6 include discussions of nineteen main resource topics where potentially significant effects may occur. Within each main resource topic, multiple subtopics also are addressed. Resource topics were selected based on internal and external public scoping and on formal Federal, State and local guidance for implementing NEPA and CEQA.

The remainder of the EIS/EIR consists of chapters 7 through 13. Chapter 7 describes other required NEPA/CEQA elements, such as growth-inducing impacts, short-term uses versus long-term productivity, and irreversible and irretrievable commitments of resources. Chapter 8 describes the public and agency involvement process. Chapter 9 provides an overview of compliance with applicable laws, policies, and plans. Chapters 10, 11, and 12 provide such supporting information as the list of preparers, the bibliography, and the index, respectively.

This EIS/EIR uses charts to represent numerical sets of data that have been generated and used to analyze how various actions, or lack of actions may affect the Salton Sea. A chart is a graphical representation of one or more sets of data that is usually easier to interpret and understand than tables of numbers. Computer software, used to graph information, plots data points and then draws a line to connect the points, forming a line. Some of the charts used in this EIS/EIR allow comparisons to be made between different actions occurring during the same time period. These charts are often used to describe water quality parameters of the Salton Sea, such as salinity and elevation, over a period of time. Figure 1.7-1 is a sample chart provided to assist the reader in understanding and interpreting the charts that will be found throughout this document.

A companion map document containing 11 by 17 full color figures is provided as a separately bound volume with this EIS/EIR. Figures within this companion document are referenced in the EIS/EIR text. These figures are also electronically available for viewing at the University of Redlands Salton Sea Database Program website, http://cem.uor.edu/salton/eis/index.cfm.

1.7.3 Supporting Studies

Two categories of supporting studies are relevant to the current analysis. The first category consists of technical investigations conducted under the direction of the Science Subcommittee and others and of earlier studies. Specific studies in this category are identified in chapter 8 and discussed where relevant within resource sections of chapters 3 through 6. The second category of studies includes the following recent NEPA/CEQA documents prepared within the Salton Sea study area:

- Final Environmental Impact Statement/Environmental Impact Report, All American Canal Lining, Imperial County, California, prepared by the Bureau of Reclamation and Imperial Irrigation District, 1994;
- Environmental Appendix for Final EIS/EIR, All American Canal Lining, Imperial County, California, prepared by the Bureau of Reclamation and Imperial Irrigation District, 1994;
- Draft Environmental Impact Statement/Environmental Impact Report for the Coachella Canal Lining Project prepared by Reclamation, 1993;
- Final Community Environmental Response Facilitation Act Environmental Baseline Survey at Salton Sea Test Base, Imperial County, California, prepared by Bechtel National, Inc., 1993; and
- Draft Environmental Impact Report and Environmental Assessment, Coachella Valley-Niland-El Centro 230 kV Transmission Project, prepared by Imperial Irrigation District and BLM, 1987.

These documents provide recent environmental information in several areas adjacent to the Sea that could be affected by restoration alternatives. Supporting documents are available for review through the University of Redlands Salton Sea Database Program website (http://cem.uor.edu/).

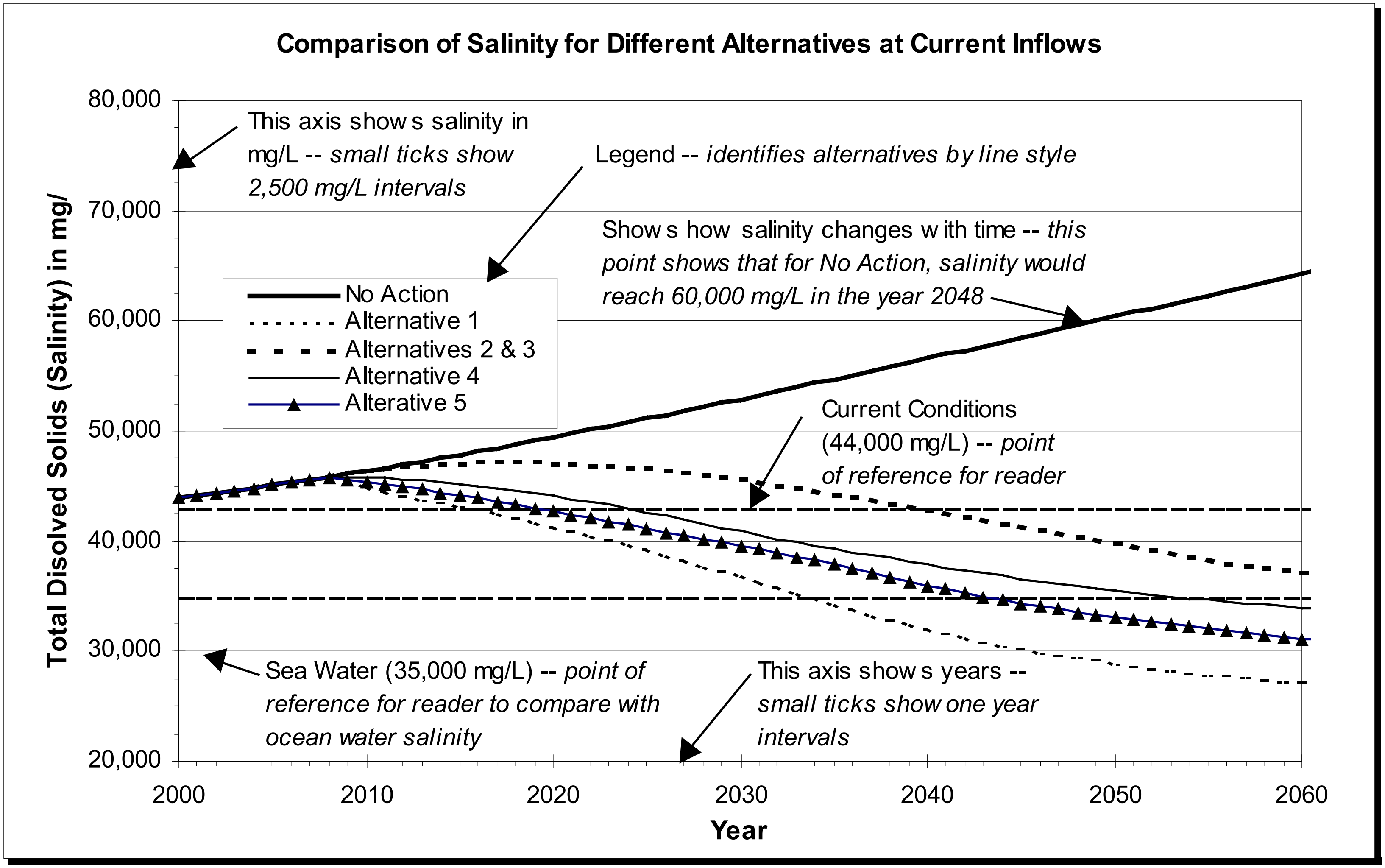


Figure 1.7-1 Sample chart used to plot salinity, similar charts are used to plot elevation

1.8 ACTIONS THAT WILL BE TAKEN BASED ON THIS EIS/EIR

Following public review and comment on this draft EIS/EIR, the joint lead agencies will analyze the public comments and will prepare a final EIS/EIR. The final EIS/EIR will include a listing of the public comments and agency responses. As the lead federal agency, Reclamation then will prepare and file a record of decision (ROD) no sooner than 30 days following the US Environmental Protection Agency's (EPA) publication of the notice of availability (NOA) of the final EIR/EIS. The Authority will consider the final EIR/EIS and certify it with findings and preparation of the Mitigation Monitoring and Reporting Plan. EIR certification under CEQA would occur through a resolution, including findings. Within five working days of project approval, the Authority will prepare and file a notice of determination (NOD), in compliance with CEQA requirements.

The NEPA ROD and CEQA findings will identify the specific actions the lead agencies intend to take as a result of the environmental review and other supporting engineering and scientific investigations and design efforts. Under NEPA, a preferred alternative must be identified in the Final EIS, although the lead agency may choose to select another alternative in the ROD. The ROD will include definitions of the mitigation and monitoring plans, adaptive management, and the long-term management plan.

Additionally, the EIS/EIR is intended to provide information to the Secretary of the Interior and to Congress on the environmental consequences of attempting to meet the project purposes. At Secretarial and Congressional discretion, this EIS/EIR may be used to inform and support their future authorization of actions at the Salton Sea.

CHAPTER 2
DESCRIPTION OF ALTERNATIVES

2.1 DEVELOPMENT OF ALTERNATIVES

2.1.1 Salton Sea Restoration Initial Planning Phase

Although projects to stabilize salinity and surface water elevation problems at the Sea have been proposed for many years, the initial planning process for the current set of alternatives began in 1996. Prior to initiation of a NEPA/CEQA process, an initial screening study was conducted in 1996 through an agreement with the Authority, the California Department of Water Resources (DWR), and Reclamation. In an effort to include a wide variety of potential solutions to the problems of the Sea, media announcements and public meetings were used to invite submittals of restoration alternatives. Through these efforts, 54 alternatives were subjected to the preliminary screening analysis. This preliminary screening effort provided the framework for developing the alternatives that are analyzed in this EIS/EIR. The NEPA/CEQA process, begun in June 1998, builds on these early efforts to incorporate concerns, issues, and comments made during these public meetings into the analysis of alternatives.

Twenty evaluation criteria were developed at an Authority public workshop held on April 8, 1996. The workshop included representatives from Reclamation, USFWS, California Department of Parks, DWR, CDFG, Authority board members, and the public. To facilitate alternative evaluation, the representatives developed a comparison technique to determine the order of importance of a list of evaluation criteria. The evaluation criteria were assigned weighted values and were ranked in order of relative importance to issues facing the Sea, as shown in Table 2.1-1. The last two criteria, water removal and benefits and impacts, were not given any weight in the first attempt at ranking, but were later assigned values of 1. Alternatives were then assigned scores ranging from 0 to 4 for each criteria, with 4 being best, and total weighted score was calculated. The results of the original screening process were published in the Salton Sea Alternative Evaluation

Table 2.1-1
Evaluation Criteria and Weighted Values

Criterion	Value	Criterion	Value
Agricultural Interest	33	Sport Fishery	14
Wildlife	32	Recreation Benefits	14
Elevation Control	31	Economic Development	11
Disposal	24	Intergovernmental Cooperation	9
Water Quality-Salinity	24	Land	7
Water Quality-Other	21	Time to Solve	6
OME&R Costs	19	Time to Construct	3
Finance Costs	17	Partnering Opportunity	2
Location	17	Water Removal	1
Construction Costs	14	Benefits and Impacts	1

Final Draft Report, which is available on the worldwide web at the US Bureau of Reclamation website, www.lc.usbr.gov.

2.1.2 Adaptation of Evaluation Criteria for the Current Effort

Following the initial alternative development and screening process and the initiation of the NEPA/CEQA process, the criteria were re-evaluated. The elimination criteria were determined to be too restrictive; consequently, a second phase of screening was initiated, in which restriction of the OME&R costs was removed. The new process involved the following:

- Working with stakeholders to determine if the original framework still made sense;
- Placing a greater emphasis on appropriate definitions and weighting; and
- Developing substantial public agreement.

Public involvement played an important role in this phase of the screening process. Four public meetings were held during the week of October 5, 1998, and were attended by approximately 100 individuals. The first meeting was with members of the Torres Martinez band of the Desert Cahuilla Indian Tribe and was designed to receive comments from the tribe on their interests. The joint leads also extended an invitation to tribal members to attend the public alternatives workshops. These workshops were designed to elicit comments regarding the alternative criteria and screening process and were held over the next three days in Desert Shores, El Centro, and San Diego. The results of the public involvement process suggested that the basic framework and approach was sound and that it should continue.

All original alternatives were reassessed, and new alternatives were considered, including those suggested by the public. The reassessment yielded 39 alternatives that were carried forward for additional screening analysis. A description of these alternatives is provided in the Salton Sea Alternatives Preappraisal Report (November 1998), which is also available on the worldwide web at www.lc.usbr.gov and incorporated by reference.

The top five alternatives, along with components of other highly rated alternatives were retained for more detailed analysis. The following alternatives received the top five scores, in order:

- Pumping Salton Sea water to the Gulf of California and importing water through the Yuma area;
- Desalting plant;
- Desalting plant with solar salt ponds;
- South basin pond system; and
- Pumping Salton Sea water to the Gulf of California and importing treated wastewater from San Diego.

In addition to scoring restoration alternatives, the No Action/No Project Alternative was evaluated. Both NEPA and CEQA require that project alternatives be evaluated against an alternative that assumes no project actions are taken to alter existing conditions. The No Action/No Project Alternative, as it is called, describes probable future conditions, based on the potential for current conditions to continue plus other assumptions regarding physical, biological, and socioeconomic features that might occur without the project. It includes historic and existing conditions and any changes or programs that have been approved and funded.

2.1.3 Alternatives Considered but Eliminated from Further Analysis

Results of the second phase of the screening process are documented in Screening Analysis of Preliminary Restoration Alternatives: Salton Sea Restoration Project (Tetra Tech 1999). This report provides a summary of the various alternatives that were carried through the second phase of the screening process but eliminated from analysis in this EIS/EIR. The process described in this report allowed the project team to focus its analysis on those alternatives that appeared to have the best potential of meeting the full set of objectives of the Salton Sea Restoration Project and goals of PL 105-372.

Out of 39 alternatives evaluated, no preliminary alternative fully satisfied all the project objectives. Therefore, the highest scoring alternatives were subjected to further evaluation and more detailed engineering design. Components of the top ranking alternatives also were combined to develop alternatives that better met the overall project objectives.

2.1.4 Alternative Refinement

At the conclusion of the screening process, the engineering effort focused on refining designs, improving cost estimates, mixing and matching components, and providing decision-makers with more information about costs, locations, and environmental consequences. Further evaluation indicated that the changes discussed in the following paragraphs were needed and that one alternative, the desalting plant, is probably not practical. The result of the alternative refinement process led to the alternatives that are evaluated in this EIS/EIR and discussed later in this chapter.

Elimination of the desalting plant alternative—The desalting plant would require a brine stream to be discharged to a receiving environment, such as the Gulf of California. Therefore, this alternative offers little advantage over similar alternatives without a desalting plant and adds considerable extra cost. It is not likely that a reverse osmosis desalting plant will receive any further consideration.

Modification of the south basin pond—After further evaluation of the large south basin pond, the cost of construction is prohibitive because of the need to make the structure earthquake tolerant. Therefore, much smaller south basin shallow water ponds are being evaluated.

Enhanced evaporation system—An enhanced evaporation system to reduce the volume of highly saline water was part of one of the original alternatives. This is now being considered on its own, and/or in conjunction with a south basin pond system and/or in conjunction with a pipeline to a dry lakebed.

Phasing of alternatives**—**As discussed above for the No Action/No Project Alternative, inflows to the Sea could be substantially reduced in the future. The current evaluation of alternatives is being conducted to assess the effects of a range of inflows from the current 1.36 million acre-feet per year (maf/yr) to a future condition of as low as 0.8 maf/yr. The need for imported water increases substantially as annual inflows decrease. Therefore, water could be imported as a later contingency phase of the project, should the need arise because of reduced inflows. In addition, a system that concentrates salinity in ponds, within or near the Sea, could operate for a number of years before a long-term solution to disposing of salt residue is constructed. Long-term disposal could be accomplished via a pipeline or local stockpiling of salt residue in a facility, such as a landfill. Therefore, a pond system with or without enhanced evaporation could be constructed in Phase 1, and a long-term disposal facility or pipeline and water imports could be constructed in Phase 2.

Common Actions**—**In addition to engineering design studies, a process was implemented to develop common actions to enhance the alternatives. These common actions would allow the alternatives to better meet the full range of objectives of the Salton Sea Restoration Program. A work group consisting of project and agency personnel was established to develop the common actions. Public meetings were held to review the alternative development process and to discuss possible common actions that would enable the alternatives to better meet project objectives.

2.1.5 Phased Implementation Strategy

The alternative screening and evaluation process has shown that certain components are needed sooner than others and that certain project components can be designed and constructed sooner than other components. For example, water imports will be needed only if future average inflows to the Sea decline; therefore, a phased alternative implementation strategy is proposed.

Phase 1 actions have been developed and analyzed in sufficient detail to allow for an appropriate action to be selected after the final version of this EIS/EIR is published. In addition to the EIS/EIR, other ongoing technical studies will be completed and made available to the lead agencies during refinement of Phase 2 actions. Recommendations will be provided by the lead agencies as to which Phase 2 actions should be retained for further analysis, design, and supplemental environmental analysis and documentation.

2.2 PREDICTIVE MODEL APPLICATIONS IN ALTERNATIVE DEVELOPMENT

A numerical water balance accounting model was used to predict the performance of alternatives assessed in this document. The model was used to predict the performance of the No Action Alternative and project alternatives under three possible future inflow scenarios. A numerical model first developed by Thiery (1998) and significantly enhanced for the Salton Sea Restoration Project (Reclamation 1999) was used to predict the salinity, elevation, and surface area of the Salton Sea over time. The most significant enhancement to the model was a new ability to perform stochastic simulations. The model was used to predict how salinity, elevation, and surface area would change over time for the No Action Alternative and for the project alternatives. The planning horizon addressed by the model is 100 years.

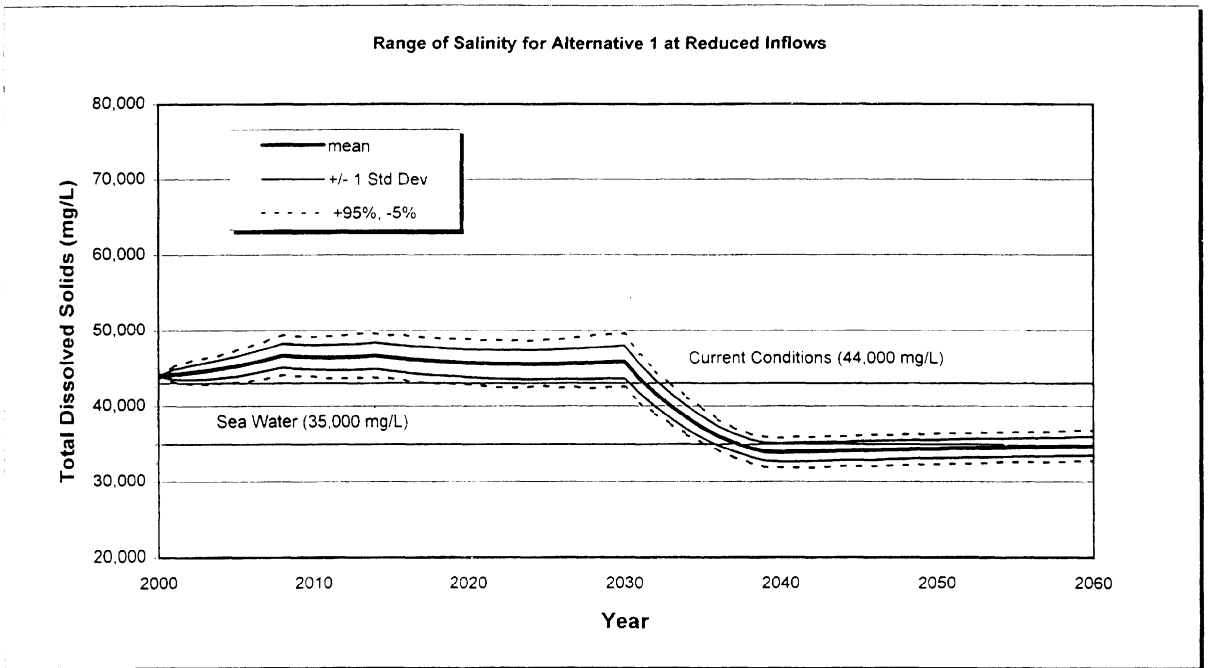
Historically, the inflow rate to the Salton Sea has varied from year to year. However, the average inflow rate over any 20 year period within the past 50 years has remained fairly stable. In any one year, changes in cropping patterns, weather, municipal use, water use in the Mexicali Valley, or variations in the deliveries through the All American Canal cause the inflow rate to the Sea to vary. The historical record indicates that in 95 percent of the years the inflow rate will not be higher than 1.55 maf/yr or lower than 1.19 maf/yr.

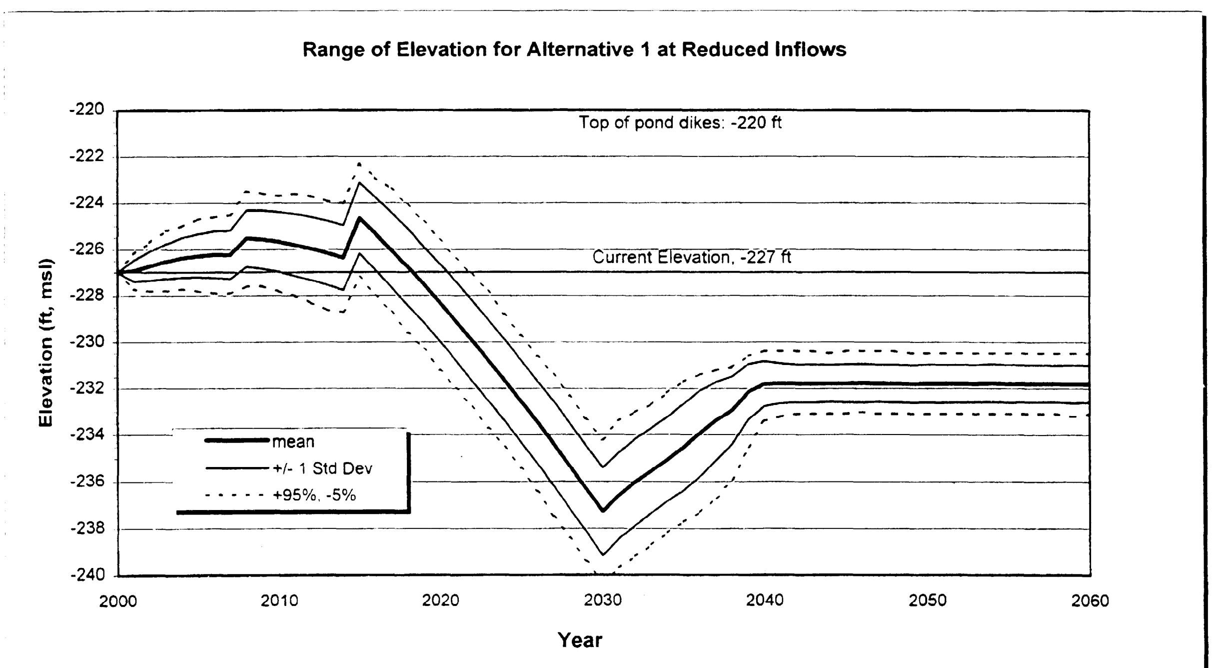
Three future scenarios were developed to predict possible inflow conditions without the project. The first scenario assumes that the mean annual inflow and standard deviation of annual inflows over the past 40+ years would continue into the future, with the mean value being about 1.36 maf/yr. The remaining two scenarios assumed there would be a gradual decline of the mean inflow value and that the standard deviation of the annual inflows would remain the same. Under the reduced inflow scenarios, the mean inflow would ultimately decline to either 1.06 maf/yr or 0.8 maf/yr. A stochastic process was used to develop future flow sequences that would preserve the statistical properties of each of the three inflow scenarios. In this process a large number of possible inflow sequences is generated for each inflow scenario.

The variability of model results is illustrated on Figure 2.2-1. Figure 2.2-1 illustrates the predicted behavior of Alternative 1, which would include construction of two evaporation ponds, under the scenario where the average annual inflow would ultimately decrease to 1.06 maf/yr. Figure 2.2-1 shows that, for water surface elevation, the standard deviation is about +/- 1 ft, and that from 5 to 95 percent of the time the elevation is within about 2 ft of the mean value in any given year.

In developing alternatives, an attempt was made to achieve model results of salinity and elevation that would be as close as possible to the objectives described in chapter 1. The elevation objective has been stated as -230 ft msl. For modeling purposes, the –230 elevation was assumed to be an upper limit, and a long-term target for the mean value of elevation was set at -232 ft msl. As a practical matter, this allows for an approximate +/- 2-ft buffer in the operating level of the Salton Sea, such that structures placed at or near the –230 ft msl elevation would not be impacted by natural variations in the elevation of the Sea. Figure 2.2-1 demonstrates generalized elevations. Actual elevations simulated in the model varied, such that the elevation of the Sea ranged between –230 and –235 ft msl. Hundreds of simulations were performed to gather enough information to draw the generalized curves shown in Figure 2.2-1. In the model, this variation is represented statistically by the standard deviation from the mean, and the upper and lower 95 percent confidence limits). As shown in Figure 2.2-1, the target elevation of -230 ft msl lies just above the upper 95 percent confidence limit, indicating that the target elevation has a low probability of being exceeded. In the simulations, the elevation of the Sea is predicted to be between the 95 percent line (approximately –230.5 ft) and the –230 ft elevation about 5 percent of the time. Upon further refinement of the modeling process in the future, this value can be adjusted closer to -230 ft msl. For modeling purposes, the long-term target for mean salt concentration was set at 37,500 mg/L. As described for the elevation objective, setting the modeling target lower than the project objective insures with a high degree of confidence that, provided that the alternative can meet the target, the upper limit of the salinity range will not exceed the project salinity target of 40,000 mg/L. Note, however, that even with the target set below the 40,000 mg/L, Alternative 1 is unable to meet the project salinity target during Phase 1.

It is likely that the project alternatives would actually perform better than indicated by the current model results. Following selection of an alternative, and during the final design phase, it will be possible to refine the model to show monthly or seasonal inflow variations. It will also be possible to model





* This model does not specifically simulate the impact of the IID/San Diego water transfer. Those impacts will be evaluated in a separate EIS/EIR and may demonstrate more or less severe salinity/elevation impacts than shown here.

Figure 2.2-1 Range of Variability in Salinity and Elevation due to Variable Annual Inflows, Alternative 1 with Reduced Inflow Scenario (1.06 maf/yr*)

management scenarios that would allow for changes in operation in response to seasonal changes in inflow. For example, with an enhanced evaporation system it may be possible to increase salt removal operations during periods of high inflow and reduce operations during low inflow periods. In this way, both seasonal and long-term elevation fluctuations could be better controlled.

More details of the modeling process along with more detailed descriptions of the project alternatives are published in a companion project planning report (Reclamation 2000).

2.3 NO ACTION/NO PROJECT ALTERNATIVE

Project alternatives must be evaluated against a scenario that could reasonably be expected to occur in the foreseeable future if the project is not approved. This evaluation allows decision-makers to compare the effects of approving a project against the effects of not approving a project. The No Action Alternative describes probable future conditions based on the potential for current conditions to continue plus other assumptions about physical, biological, and socioeconomic changes that might occur without the project. The No Action Alternative includes historic and existing conditions and any changes or programs that have been approved and funded. In addition, the No Action Alternative includes expected and reasonably predictable changes to all aspects of the environment that can be anticipated without the project.

According to Public Law 105-372, "In evaluating options, the Secretary shall apply assumptions regarding water inflows into the Salton Sea Basin that encourage water conservation, account for transfers of water out of the Salton Sea Basin, and are based on a maximum likely reduction in inflows into the Salton Sea Basin which could be 800,000 acre-feet or less per year." Given this direction to evaluate a range of inflows from the current average inflow of 1.36 maf/yr to 0.8 maf/yr, the Salton Sea Restoration Project alternatives have been designed to function under a variety of inflow scenarios. Project effects will be evaluated against three No Action/No Project scenarios, each with different inflows: current inflow conditions and incremental reductions using assumed average annual inflows of 1.06 maf/yr and 0.8 maf/yr.

Projecting hydrologic conditions for this project is complicated by uncertainties of future water flows into the Sea. The flow of water will depend on external factors not associated with the Salton Sea Project, and the timing of the flow is unknown. Acknowledging these uncertainties, the law directs the project to consider potential reduced future inflows in feasibility studies and these potential future reductions in inflows to the Sea were considered in the design engineering of actions evaluated as alternatives. Thus, possible No Action conditions can be defined with both current and reduced flows. Therefore, for purposes of analysis, project effects have been evaluated against three No Action/No Project inflow scenarios:

- Current (present-day) inflow conditions continue throughout both Phases 1 and 2, with average annual inflows of 1.36 maf/yr;

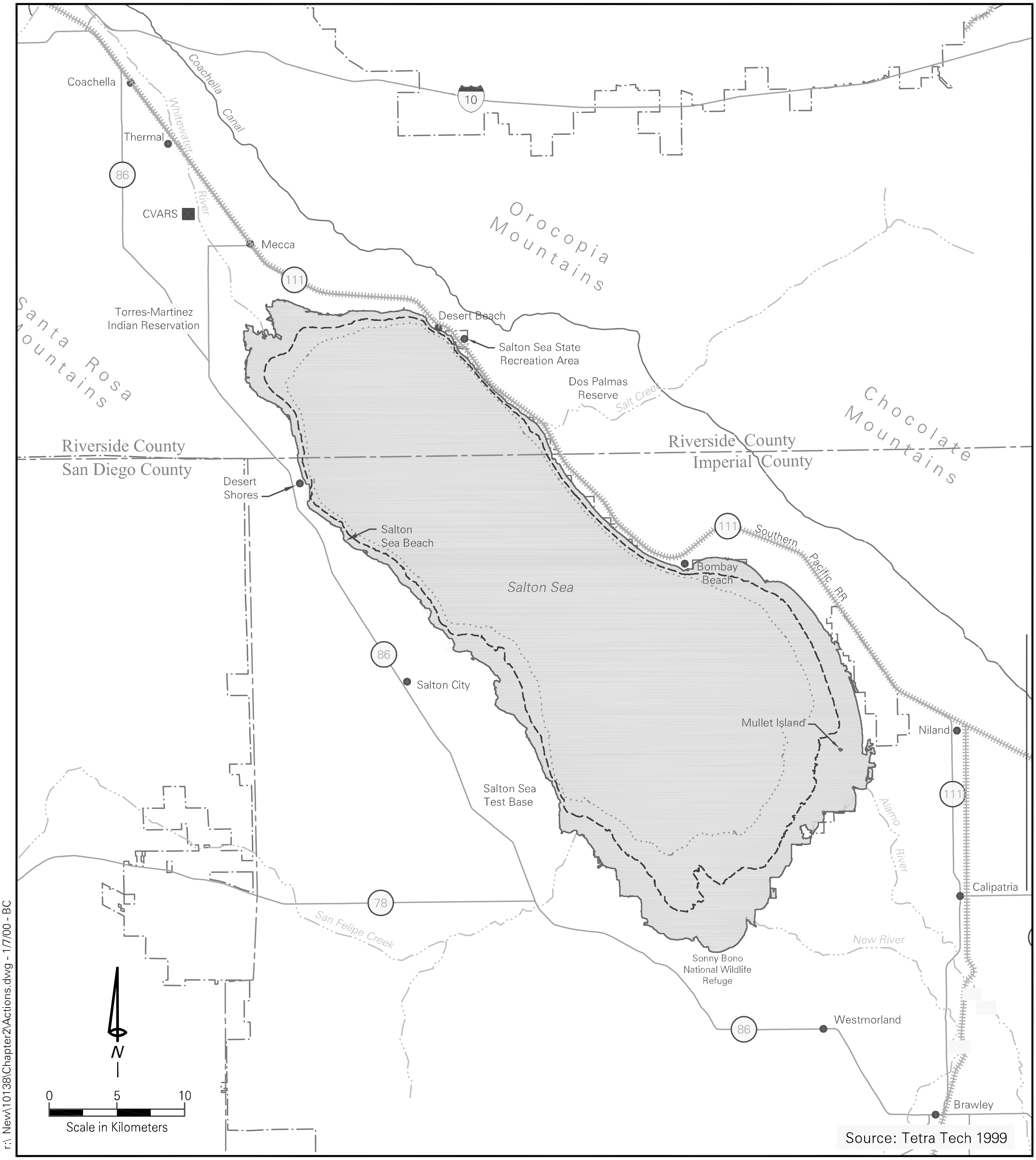
- Average annual inflows are incrementally reduced throughout Phase 1 to 1.06 maf/yr at the beginning of Phase 2; inflows remain at 1.06 maf/yr throughout Phase 2; and
- Average annual inflows are incrementally reduced throughout Phase 1 to 1.06 maf/yr at the beginning of Phase 2, and continue to decline at the same rate into Phase 2 until they reach 0.8 maf/yr.

These potential future inflows are considered reasonable future scenarios, in light of the varied projects currently under consideration that may ultimately gain approval. Figure 2.3-1 illustrates potential shoreline locations, based on model projections for 2060, which could be associated with the No Action Alternative for each of the three inflow scenarios.

The reduced inflow scenarios assume only that reductions of inflow may take place over time. Agricultural to urban water transfers may account for a majority of inflow reductions over time. Such transfers can be accomplished in a variety of ways. It is beyond the scope of this EIS/EIR to identify how current and future proposed transfers will be accomplished. However, it is important to note that alternative mechanisms to transfer water do exist and do have markedly different impacts on flows to the Salton Sea. System improvements, such as lateral interceptors, and on-farm conservation involving pumping back "tailwater" for reuse would likely have a more negative impact on the Salton Sea and its tributaries. These systems essentially reduce the relatively "good" inflow water (tailwater) into the Sea and increases the relative impact the "poorer" quality water (tile water) has on these surface waters. For every acre-foot of water conserved using a pumpback system will mean one less acre-foot (maximum probable impact) entering the agricultural drains and ultimately the Salton Sea. Other alternatives to pumpback systems do exist: converting agricultural land to a less water intensive use (e.g. intermittent wetlands) and temporary fallowing or other options. Generally, these other alternatives will result in a less than a one to one loss of water to the Sea. The less than a one to one loss means a better water quality would remain in the drains and a resultant better water quality flowing to the Sea.

Depending on the magnitude of an inflow parameter, the quantities may be expressed in units of million-acre-feet per year (maf/yr), or in units of thousand-acre-feet per year (kaf/yr) or simply acre-feet per year (af/yr). All of these units are used in this EIS/EIR.

In the future, in addition to changes in the quantities of inflows, the quality of inflowing water may also change. The California Regional Water Quality Control Board, Colorado River Basin Region (CRWQCB – CRBR) has primary



Legend

Lakeshore at 241 feet Below Sea Level (Average inflow = 1.06 million acre-feet)

Lakeshore at 249 feet Below Sea Level (Average inflow = 800,000 acre-feet)

Possible Future Shorelines at 2060 with No Action Alternative

Salton Sea, California

Figure 2.3-1

jurisdiction over the establishment and enforcement of Water Quality Standards (WQSs) for waters within its Region, pursuant to the United States Clean Water Act (CWA) and the California Porter-Cologne Water Quality Control Act (Porter-Cologne). WQSs are defined as provisions of State or Federal law, which consist of a designated beneficial use or uses of waters of the United States and water quality criteria for such waters, based upon such uses. The Regional Board's WQS for waters of the Region are contained in the Board's "Water Quality Control Plan for the Colorado River Basin Region (Basin Plan)."

The California Environmental Quality Act (CEQA) requires an analysis of past current, and reasonably foreseeable future actions that may affect the project. CWA § 303(d) requires the CRWQCB to: (1) identify the Region's waters that do not comply with water quality standards applicable to such waters, (2) rank the impaired water bodies taking into account factors including the severity of the pollution and the uses made of such waters, and (3) establish Total Maximum Daily Loads (TMDLs) for those pollutants causing the impairments to ensure that impaired waters attain their beneficial uses. If the State fails to develop a TMDL, or if USEPA rejects the State's TMDL, USEPA must develop one. Upon approval of the TMDL by USEPA, the State is required to incorporate the TMDL, along with appropriate implementation measures, into the State Water Quality Management Plan.

Pursuant to CWA § 303(d), the CRWQCB – CRBR is developing a silt TMDL for the Alamo River and a bacteria TMDL for the New River. Following the completion of the current target TMDLs, Regional Board staff will begin development of other TMDLs in accordance with the priority ranking established on the Regional Board's 1998 § 303(d) list and pursuant to funding. The TMDL process should have a long-term beneficial effect on the quality of waters flowing into the Sea. This benefit is expected to occur under the No Action Alternative as well as under project alternatives. While the project alternatives are focused on restoration of the Sea itself, the TMDL process should enhance the effectiveness of the restoration alternatives by improving the quality of the inflows.

2.4 RESTORATION ALTERNATIVES EVALUATED IN THE EIS/EIR

2.4.1 Overview

Alternatives have been developed with the recognition that inflows to the Sea may decrease in the future. Thus, each alternative includes actions that would be implemented under the reduced inflows considered. Table 2.4-1 displays how five complete alternatives have been formulated from individual actions for three inflow scenarios described in the previous section for the No Action alternative. A detailed description of each alternative is provided in sections 2.4.2 through 2.6.2. Schematic representations of all five alternatives can be found in Appendix A.

Table 2.4-1
Summary of Salton Sea Restoration Project Alternative Actions

Inflow (maf/yr)	Phase 1 (before 2030) 2003	Phase 1 (before 2030) 2008	Phase 1 (before 2030) 2015	Phase 2 (2030 and beyond) 2030	Phase 2 (2030 and beyond) 2060
Alternative 1					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	2 Ponds at 98 kaf/yr Pupfish Pond	Accelerated Export – 150 kaf/yr[1]		
1.06	Same as above	Same as above	Same as above, plus Displacement Dike	Import Central Arizona Salinity Interceptor (CASI) Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above, plus Import Flood Flows	
Alternatives 2 and 3					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	150 kaf/yr EES (showerline technology)			
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Import CASI Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above	Additional Displacement or Inflow
Alternative 4					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	100 kaf/yr EES 1 Evaporation Pond (S) at 68 kaf/yr Pupfish Pond		Increase EES capacity to 150 kaf/yr	
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Same as above, plus Import CASI Water (up to 304.8 kaf/yr, as required) Reduce EES at 100 kaf/yr	
0.80	Same as above	Same as above	Same as above	Same as above	
Alternative 5					
1.36	Fish Harvesting Improve Rec. Facilities Shoreline Cleanup Wildlife Disease Control North Wetland Habitat	150 kaf/yr EES in-Sea Evaporation Pond (N)		Export – 150 kaf/yr	
1.06	Same as above	Same as above	Displacement Dike Import Flood Flows	Import CASI Water (up to 304.8 kaf/yr, as required)	
0.80	Same as above	Same as above	Same as above	Same as above	Additional Displacement or Inflow

[1] Accelerated export implemented as a Phase 2 action

The alternatives are designed to address the wildlife, fishery, and recreation goals and objectives presented in chapter 1. In part, these objectives would be addressed by halting the present trend of increasing salinity and by ultimately reducing salinity to a target concentration of about 40,000 mg/L or below. All alternatives include salinity control measures during Phase 1. For Alternatives 1 and 5, an additional export action would be required to provide long-term salinity control. This action could be required as early as 2015 for Alternative 1, and is considered an accelerated Phase 2 action. Export options under consideration are described in Section 2.6.

Historically, the rising water levels in the Sea have flooded facilities in near-shore areas, including camping and boating facilities. The uncontrolled changes in the Sea's level have affected recreational uses and may be limiting the potential for economic development that depends on the Sea. Continued fluctuations in elevation also may adversely affect rookery success for some of the avian species that nest at the Sea. All of the alternatives presented are designed to help stabilize elevation of the Sea to a range around -230 feet, mean sea level (msl).

Four common actions have been developed to further address the goals of wildlife maintenance and enhancement, restoration of recreational uses, maintenance of the sport fishery, and identification of economic development opportunities. The common actions are designed to supplement the alternative actions discussed below. The common actions would be included with each alternative except No Action, and could be implemented as early as 2003. To avoid repetition, each common action is discussed once in Section 2.5.

All alternatives, including No Action, have been analyzed using a water-budget accounting model that includes a stochastic analysis of multiple future inflow scenarios. Table 2.4-2 provides a summary of the model results of the expected values of salinity, elevation, and surface area associated with each alternative at specific times. Predicted mean values of salinity and elevation over time for each of the alternatives are shown on figures 2.4-1 through 2.4-3 for each of the three assumed inflow scenarios.

2.4.2 Alternative 1

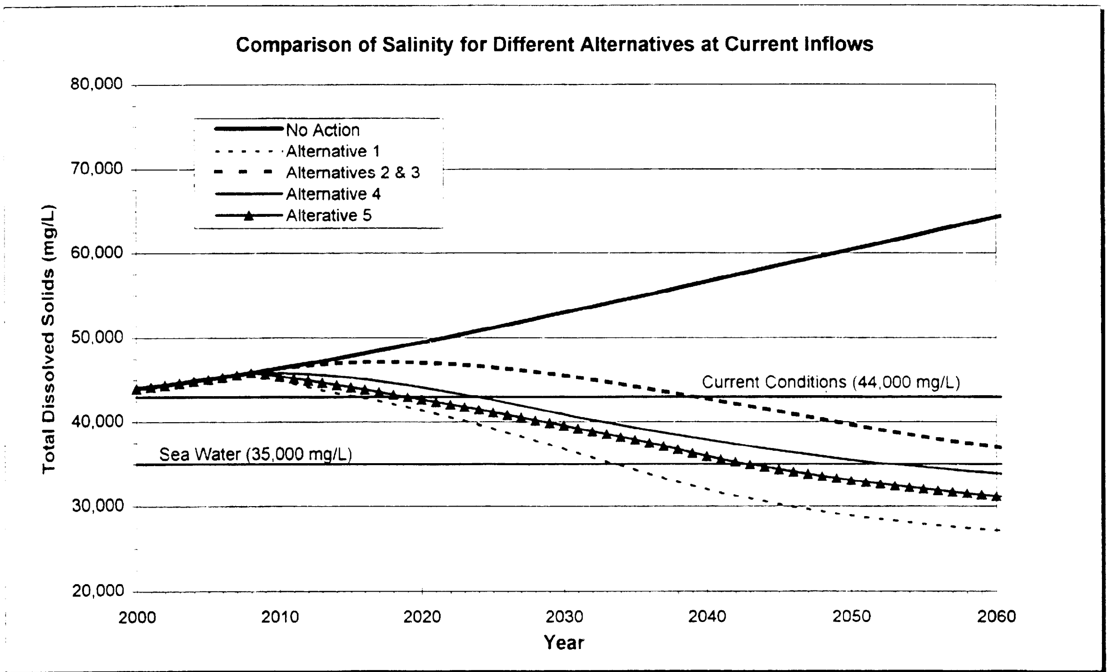
Current Inflow Conditions – Alternative 1: Phase 1

Evaporation Ponds: In addition to the common actions described in Section 2.5, Alternative 1 would involve construction of two evaporation ponds within the Sea. The combined surface area of the ponds would be approximately 33 square miles but would depend on the elevation of the water surface in the ponds and may also fluctuate seasonally. The ponds would act to concentrate the salts from the Sea and to assist in stabilizing the Sea's surface elevation. Approximately 98,000 af/yr of water would be pumped into these ponds from the Sea each year. Evaporation of this water would tend to concentrate salts in the ponds and allow

Table 2.4-2
Summary of Modeling Results and Assumptions

Inflow Rate/Alternative	Middle of Phase 1 2015 Elevation (ft, msl)	Salinity (mg/L)	Surface Area (acres)	Surface Area (sq mi)	End of Phase 1/Start of Phase 2 2030 Elevation (ft, msl)	Salinity (mg/L)	Surface Area (acres)	Surface Area (sq mi)	30 years of Phase 2 2060 Elevation (ft, msl)	Salinity (mg/L)	Surface Area (acres)	Surface Area (sq mi)
Current Inflow Scenario, 1.36 maf/yr												
No Action	-225	47,835	238,955	373	-224	52,896	241,436	377	-223	64,253	243,576	381
Alternative 1	-224	43,166	217,474	340	-229	36,824	208,385	326	-227	27,196	212,146	331
Alternatives 2 & 3	-229	47,043	230,640	360	-232	45,510	222,881	348	-234	37,042	219,255	343
Alternative 4	-227	44,161	219,616	343	-229	39,566	216,199	338	-229	31,165	215,126	336
Alternative 5	-229	45,246	223,348	349	-232	40,854	217,996	341	-231	33,926	218,808	342
Reduced Inflow Scenario, 1.06 maf/yr												
No Action	-228	52,001	232,980	364	-234	75,050	218,371	341	-241	122,530	198,267	310
Alternative 1	-225	46,394	200,091	313	-237	45,862	181,074	283	-232	34,742	189,404	296
Alternatives 2 & 3	-230	50,847	213,002	333	-237	53,726	196,945	308	-232	38,120	208,371	326
Alternative 4	-228	47,575	202,134	316	-235	47,467	190,758	298	-232	40,436	195,877	306
Alternative 5	-230	48,857	205,790	322	-236	46,197	195,738	306	-232	37,343	202,843	317
Reduced Inflow Scenario, 0.80 maf/yr												
No Action	-228	51,998	232,978	364	-234	75,043	218,368	341	-249	177,848	169,435	265
Alternative 1	-225	46,405	200,086	313	-237	45,868	181,064	283	-234	38,203	186,677	292
Alternatives 2 & 3	-230	50,846	213,000	333	-237	53,668	197,032	308	-238	45,347	184,159	288
Alternative 4	-228	47,574	202,133	316	-235	47,508	190,717	298	-234	44,467	191,537	299
Alternative 5	-230	48,849	205,782	322	-236	46,161	195,776	306	-236	40,745	195,443	305

Notes: *Base Year: 2000*
Elevation in Base Year: -227 ft msl
Salinity in Base Year: 44,000 mg/L
Surface Area of Sea in Base Year: 233,898 acres (365 square miles)



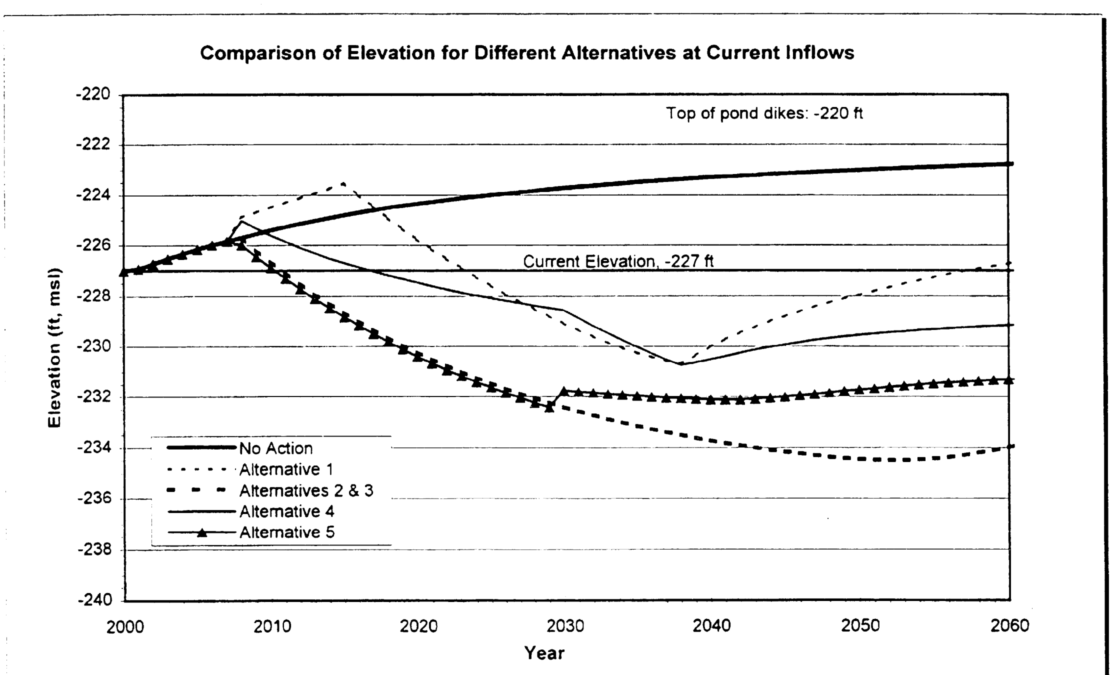
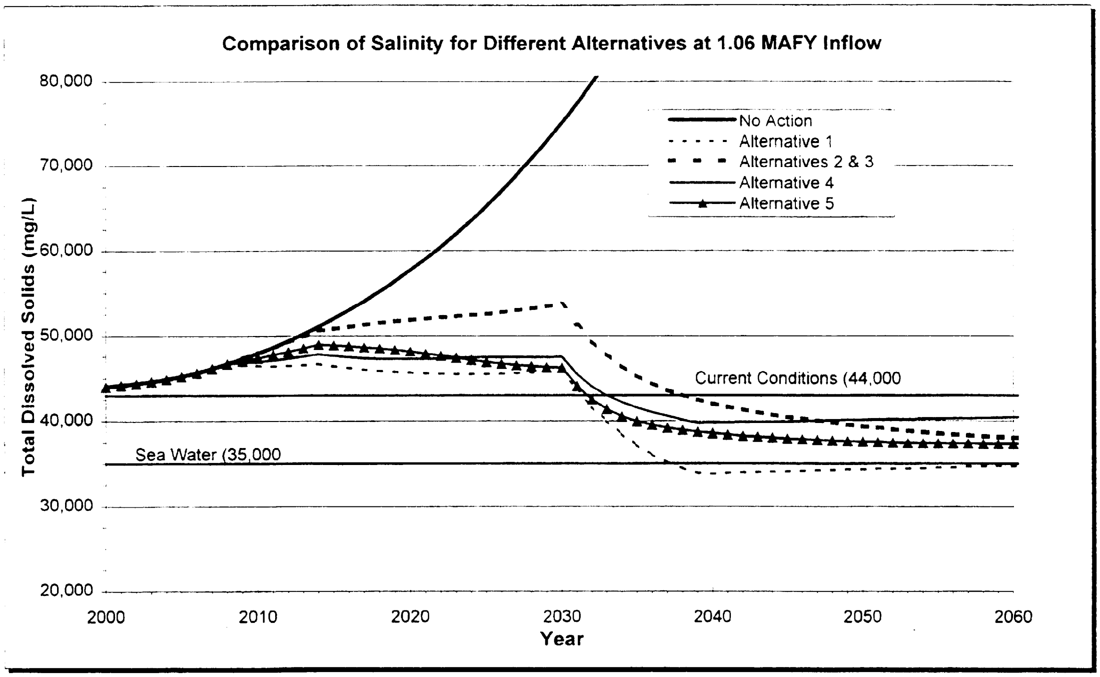
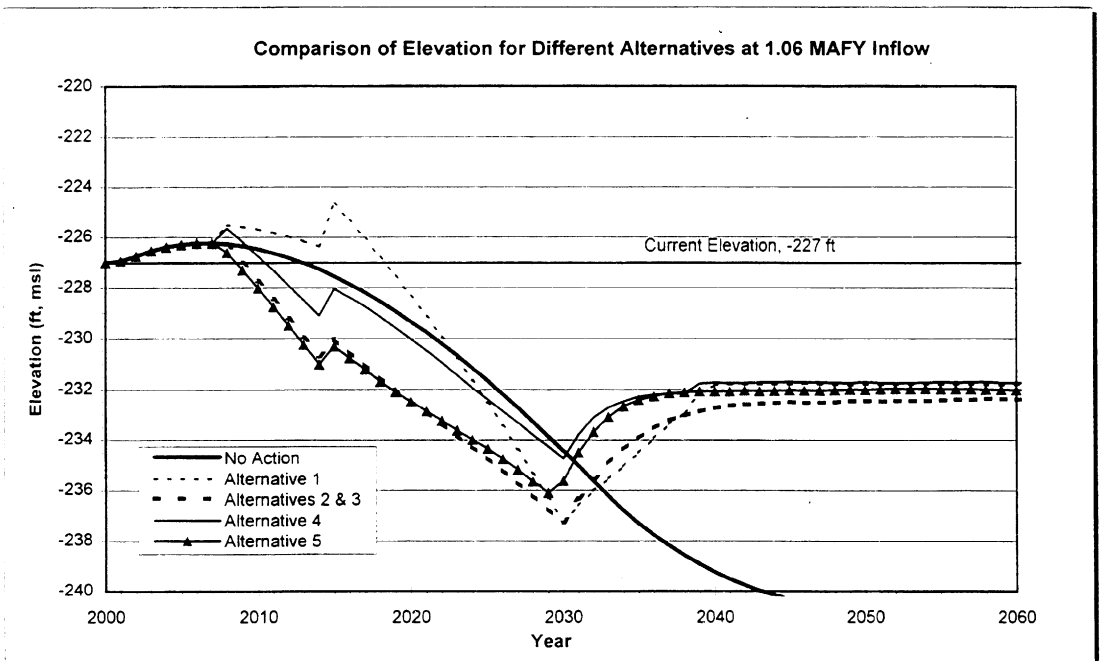


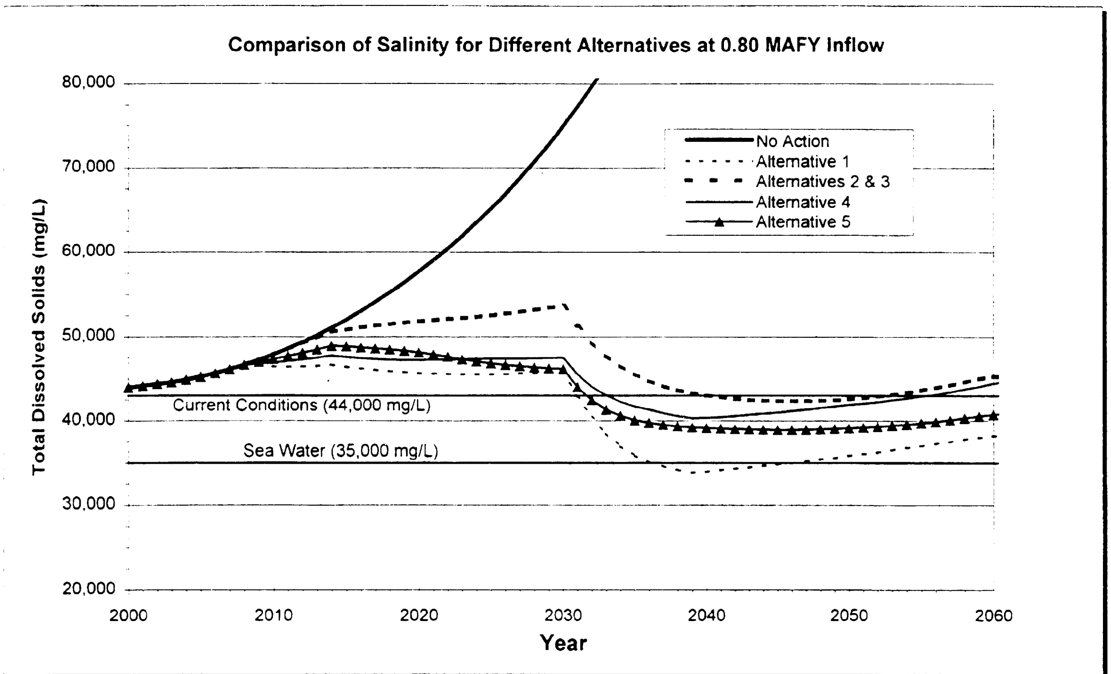
Figure 2.4-1. Projected Changes in Salinity and Elevation Over Time at Current Inflows





* This model does not specifically simulate the impact of the IID/San Diego water transfer. Those impacts will be evaluated in a separate EIS/EIR and may demonstrate more or less severe salinity/elevation impacts than shown here.

Figure 2.4-2. Projected Changes in Salinity and Elevation Over Time with Inflow Reduced to 1.06 maf/yr *



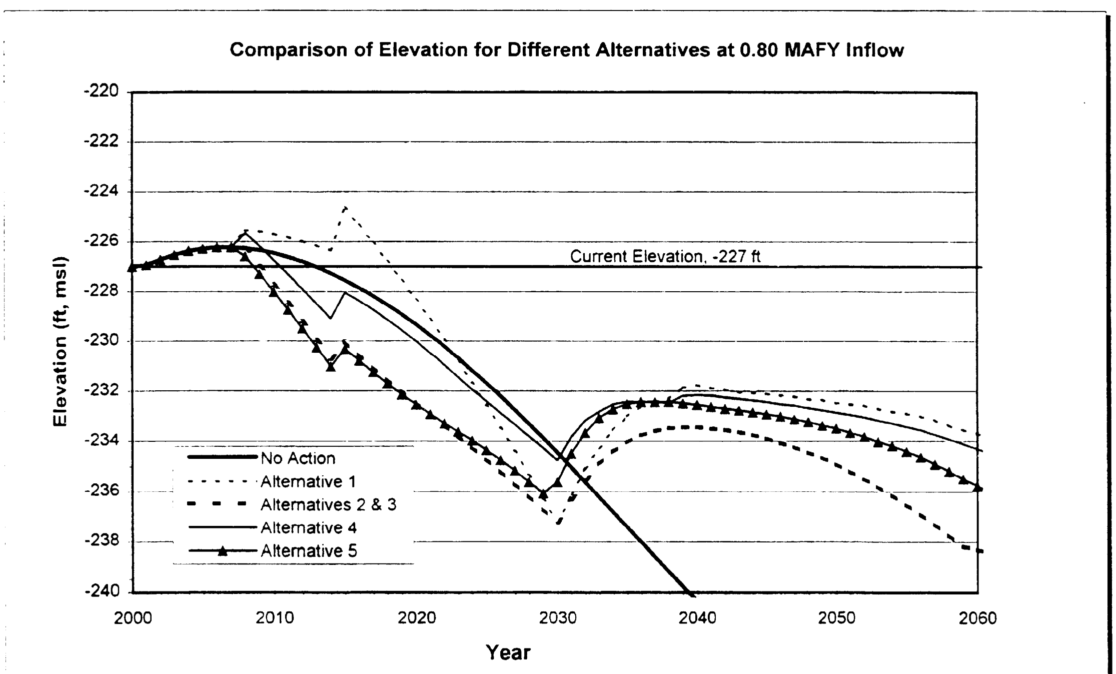


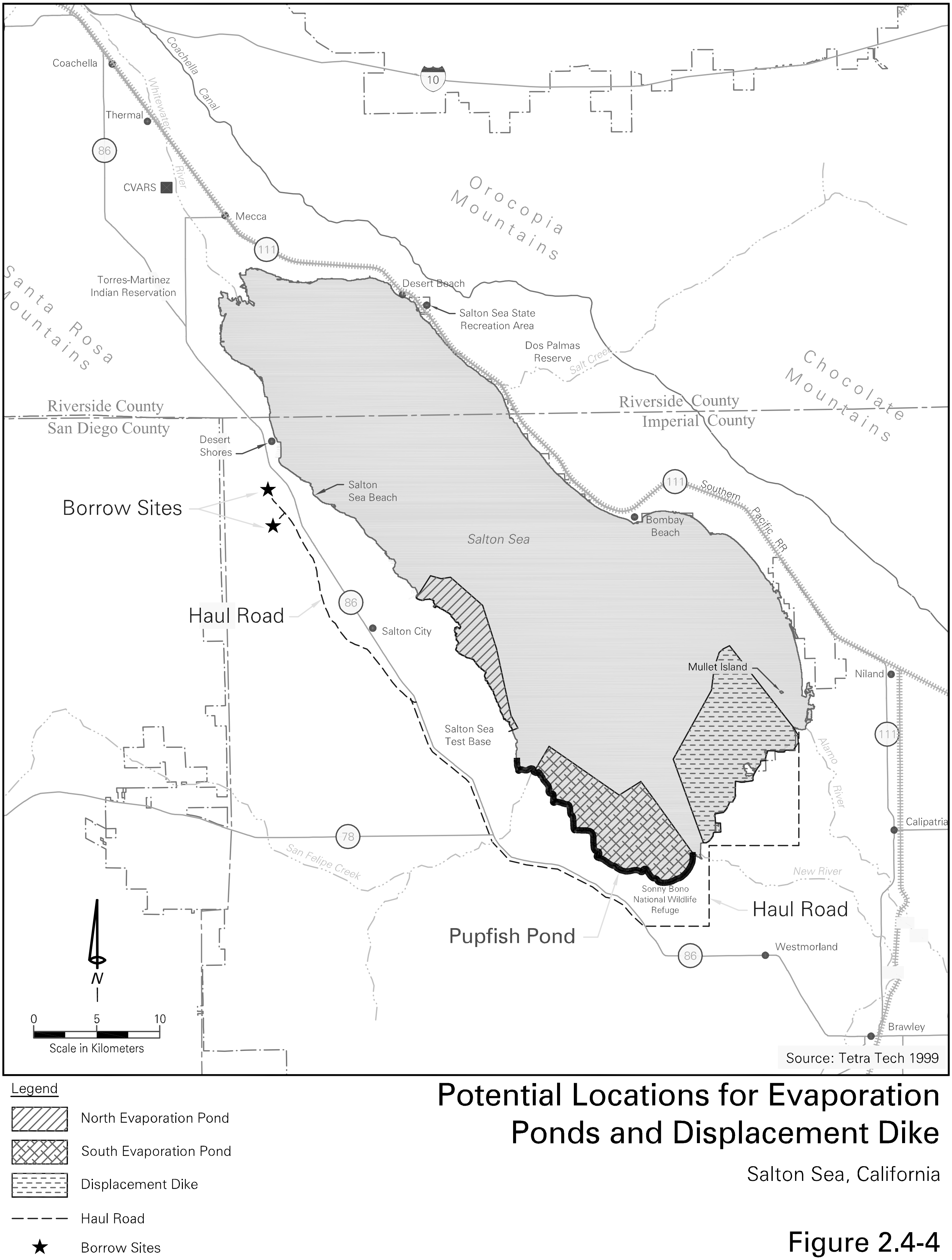
Figure 2.4-3. Projected Changes in Salinity and Elevation Over Time with Inflow Reduced to 0.80 maf/yr

the salinity in the remainder of the Sea to be maintained at an acceptable level. The ponds would also create a displacement, which would assist in maintaining the target elevation level of the Sea (+/- -230 feet), should inflows to the Sea decrease in the future.

Construction activities would temporarily disturb some areas along the shoreline, would take approximately 48 months to complete, and would involve a maximum of 440 to 480 workers. Construction resources are included on Table 2.4-3; the location of the evaporation ponds is shown on Figure 2.4-4.

Table 2.4-3
Salton Sea Restoration Resource Requirements for Selected Phase 1 Actions

Resource Requirements	Evaporation Ponds	EES at Bombay Beach or Test Base	Displacement Dikes	North Wetland Habitat
Surface Area Disturbance (acres)				
• On-shore Area Disturbed				
- Temporary Construction Disturbance	280	26	360	3
- Area Permanently Converted to a New Use	0	7,500	0	Less than 1
• In-Sea Area Disturbed				
- Temporary Disturbance	735	20	520	21
- Area Occupied by New Structures	735	20	520	21
- Pond or Displacement Surface Area	21,900	N/A	13,500	1,000
Construction Schedule				
• Approximate Start Date	Jan. 2, 2002	Jan. 2, 2002	2015	Varies
• Duration of Construction (months)	48	36	48	24
• Phases of Construction	2	0	2	2
• Period of Peak Construction Activity (months)	40	36	40	20
Work Force				
• Construction Phase				
- Average Number of Workers	440	260	300	12
- Peak Number of Workers	480	300	330	12
• Operations Phase Workforce	Less than 5	72	Less than 5	Less than 5
Construction Resources				
• Riprap Revetment (1,000 cubic yards)	490	0	323	Less than 2
• Hydraulically Excavated Sludge (1,000 cubic yards)	7,100	0	4,726	0
• Aggregate (1,000 cubic yards)	21,100	45,000	14,500	0
• Water use (gallons per day)	38,000	300,000	26,000	0
Power Requirements				
• Construction Phase				
- Average Load (kilowatts)	Minimal	250	Minimal	25
- Peak Load (kilowatts)	Minimal	500	Minimal	25
• Operations Phase				
- Average Load (kilowatts)	Minimal	9,500	Minimal	25
- Peak Load (kilowatts)	Minimal	12,700	Minimal	25
Construction Traffic				
• Average daily truck trips (trips per day)	1,000	2,100	690	1
• Peak daily truck trips (trips per day)	1,024	2,100	700	10
• Haul routes (miles)	2@18 mi	varies	50	Varies



Potential Locations for Evaporation Ponds and Displacement Dike

Salton Sea, California

Figure 2.4-4

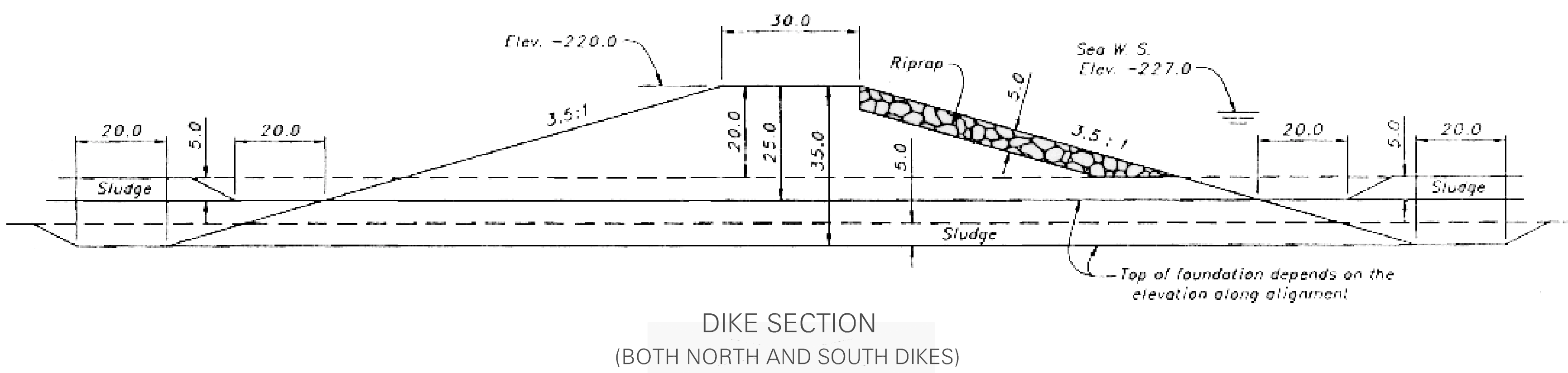
The evaporation ponds would be constructed by first dredging sludge material by suction from the dike foundation area using floating barges. A minimum of one trailing hydraulic high-production dredge mounted on a barge would likely be used per dike. Dredged material would be discharged into the sea between two floating silt barriers anchored to the Sea bottom and ultimately would be redistributed by currents throughout the Sea over time. Dredging would begin several months ahead of the earthfill placement operation and would proceed ahead of the fill at a reasonable distance.

Dikes containing the ponds would be a maximum of approximately 35 feet high, measured from top of foundation, and 30 feet wide on top. The dikes' footprint beneath the Sea would cover approximately 1.2 square miles (735 acres). A typical dike cross section is provided as Figure 2.4-5. While the north evaporation pond dike would intersect the shoreline at both ends of the pond and use the shoreline to close the pond on the west side, the south evaporation pond would be constructed completely within the Sea. This is necessary to protect the near shore habitat of the federally listed endangered desert pupfish.

Borrow material would be trucked into the construction site by way of a 60-foot wide dedicated temporary haul road. The gravel-based road would originate at the borrow area west of Salton Sea Beach within the Torres Martinez Indian Reservation or commercial borrow areas. Riprap would come from Section 20, T9S, R9E; embankment material would come from sections 28 and 34, T9S, R9E. Approximate locations of borrow areas are shown on Figure 2.4-4. As shown on Figure 2.4-4, the haul road would extend south along the west side of Highway 86, approximately 16 miles to a point due west of the construction site within the test base. A traffic control system would stop vehicles on the highway to allow the haul trucks to cross. Alternately, a bridge could be constructed to cross the highway at the same location. Once construction of the dikes is completed, the road would be restored to pre-construction condition.

The dike foundation and where it meets the dike embankment would be constructed to meet design and safety assumptions. This could involve special materials handling and placement methods on the dike itself to avoid haul materials from being re-handled. A bottom dump placement barge could be used for this task or materials could be transported along the constructed dike. Detailed construction procedures would be determined after final designs of the ponds and dikes are completed. The evaporation ponds are expected to be efficient for the first 30 years of the project. At the end of this 30-year operational lifespan, the water behind the dikes would be allowed to evaporate. Depending on their condition, the dikes probably would be reinforced on the pond side and left in place, along with the salt. The area would be capped with soil, if necessary.

<u>Pupfish Pond</u>: What little is known about pupfish ecology at the Sea suggests that their habitat includes not only the creeks and drains that empty into the Salton



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Dike Cross Section

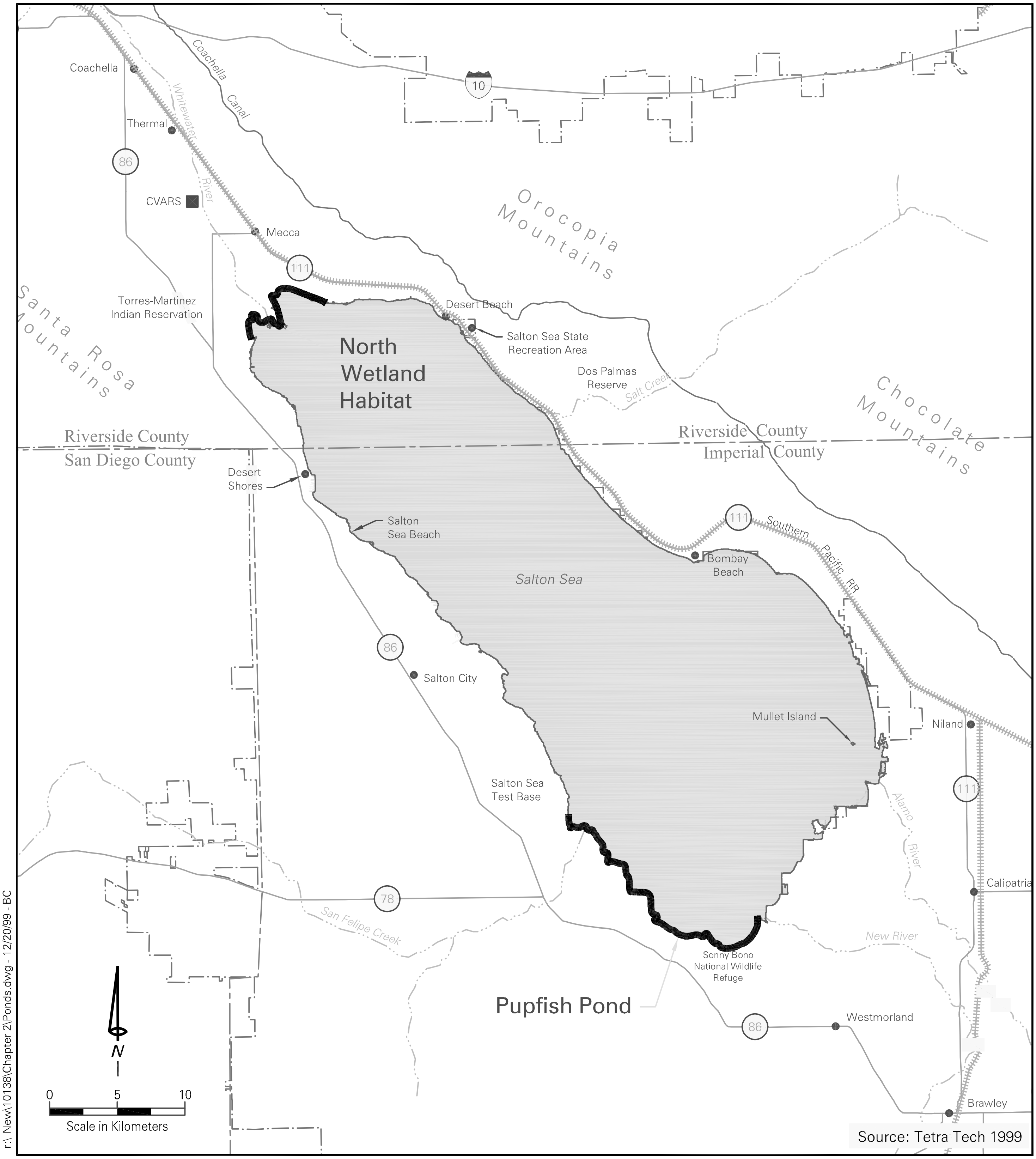
Salton Sea, California

Figure 2.4-5

Sea, but also the shallow areas along the shoreline. Pupfish use the shallow areas to move between the creeks and drains, while evading their predators in the Sea, such as the tilapia. This movement from inlet to inlet might contribute to maintaining a healthy desert pupfish population in the Salton Sea by providing genetic diversity and hence, a stronger species and is therefore, important to protect.

To maintain this habitat and connectivity between the drains in this area, additional dikes would be constructed from the north and south ends of the south evaporation pond extending to the shoreline, effectively creating a nearshore habitat protection pond between the shore and the evaporation pond. Significant snag habitat on the west side of the New River and the habitat around the mouth of San Felipe Creek would also be protected within this pond. Salinity levels appropriate to maintain conditions suitable for pupfish habitat would be attained by using a pump system, bringing in Salton Sea water to mix with a smaller portion of drain water. Water quality levels will be monitored as a part of the management actions described in section 2.7. The pupfish pond location is shown on Figure 2.4-6. A cross-section of a typical pupfish pond dike is shown on Figure 2.4-7. Borrow material would be transported into the construction site in the same manner described for the evaporation ponds under Current Inflow Conditions – Alternative 1: Phase 1.

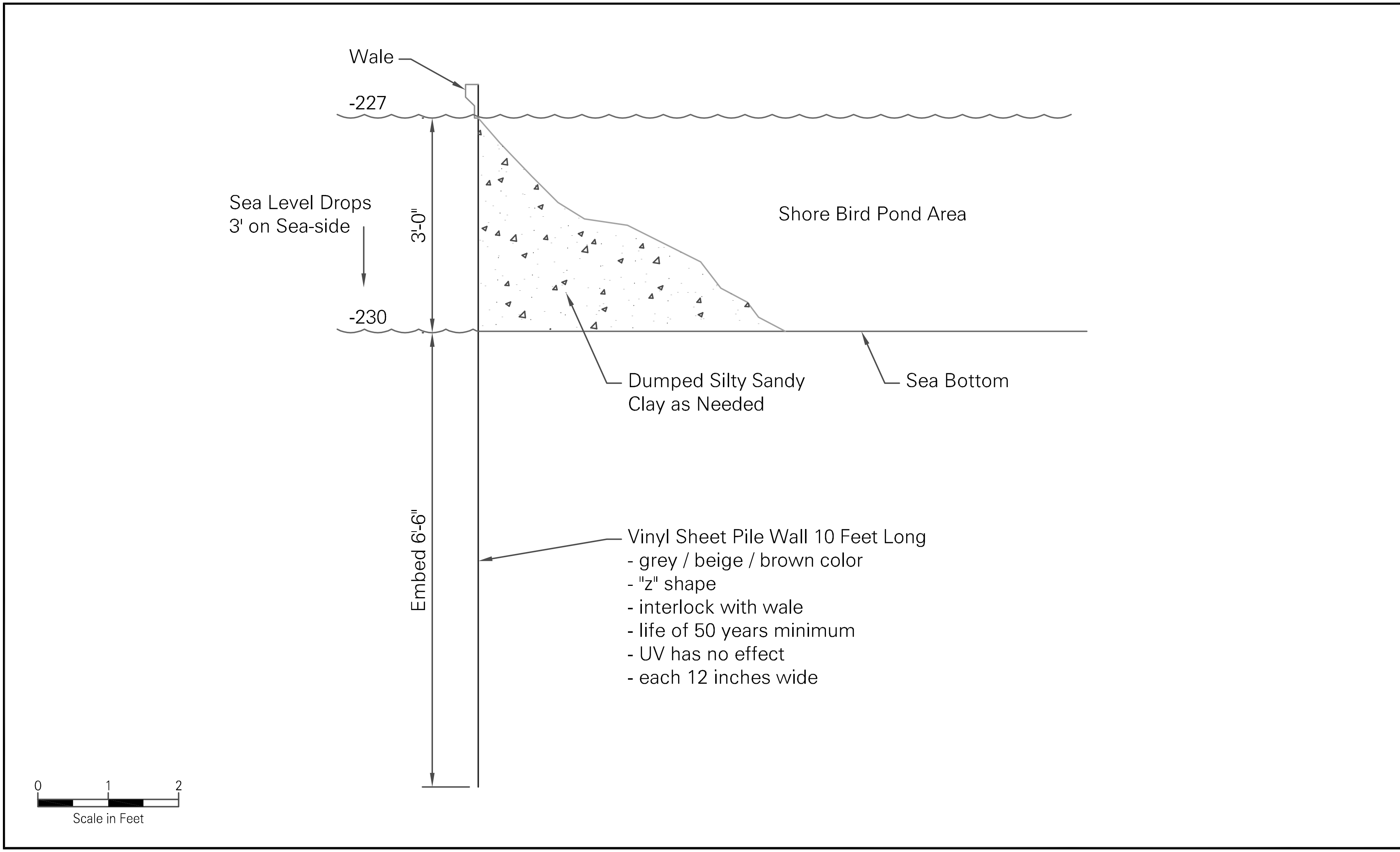
<u>North Wetland Habitat:</u> Reduced annual inflows to the Sea would threaten the important island and snag habitat currently used by wildlife in the northern portion of the Sea. This area provides the largest expanse of snag habitat at the Sea along with low island habitat. The north wetland habitat area would be constructed to preserve these existing values in the area as well as allow adaptive management of a freshwater/Salton Sea water interface to enhance habitat values. Prior to construction of the wetland, physical and biological parameters would be measured and recorded to use as a baseline for evaluating changes that occur ofter construction, in accordance with adaptive management strategies. Dikes would be constructed at the -230 foot contour on both sides of the Whitewater River Delta, leaving the mouth of the Whitewater River free to flow in to the Sea. The created ponds would have up to 3 feet of water depth and would ensure that the several low islands within the area would not become connected to the shoreline due to drops in elevation. The western dike system would begin west of the mouth of the Whitewater River and continue approximately 2 miles west along the -230 foot contour to the Avenue 76 drain. The eastern dike system would begin east of the mouth of the Whitewater River and continue approximately 3 miles east along the-230 foot contour. The distance from shoreline would range between approximately 100 feet to a maximum distance of 1,800 feet. The total area within the two diked areas would total about 1,000 acres. Figure 2.4-6 shows the location of the North Wetland Habitat.



Potential Locations of North Wetland Habitat and Pupfish Pond

Salton Sea, California

Figure 2.4-6



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Typical Dike Cross Section for North Wetland Habitat and Pupfish Pond

Salton Sea, California

Figure 2.4-7

The two habitat areas would be constructed using 10-foot long sheet piling which would be driven into the Sea bed about 6 feet. Sheet piling forms a Z-shaped dike when completed. A cross-section of a typical sheet-piling dike is shown on Figure 2.4-7. Construction would be accomplished from barges or with specialized equipment. During construction, occasional piles of rock would be placed against the sheet piling to provide roosting and nesting opportunities and provide rock substrate for benthic invertebrates. Water from the Whitewater River would be pumped or gravity fed into the two areas in a manner which allows for gravity flow through the system. Water within the two areas would be at a slightly higher elevation then that of the Sea, allowing for gravity flow back into the sea via outflow structures. Maximum capacity for diversion would be approximately 100 cfs into each area. Pumping facilities would be constructed to supplement the outflow structures to allow maximum flexibility of water elevation and water quality management. Water quality would be monitored before and after construction, as part of the management actions described in sections 2.5.6 and 2.5.7.

Once the existing habitat values have been protected, the north habitat areas would be used to test management techniques to enhance threatened habitat values within the Salton Sea. Interior dikes, upland management, and adaptive management of sub-units would be developed as appropriate in the future. These interior features would be developed as goals for the entire Sea as part of the long-term management and strategic science plans described in sections 2.5.6 and 2.5.7, respectively. Any future construction or management may require additional compliance actions before implementation. Knowledge gained through the management of the north wetland habitat would be applied to other areas along the shoreline of the Sea, as appropriate. If selected, construction on this action would begin as soon as possible so that the north wetland habitat could be in place by as early as 2003.

Current Inflow Conditions – Alternative 1: Phase 2

<u>Export</u>: Generally, it has been assumed that Phase 2 actions would be implemented around the year 2030. However, for this alternative, Phase 2 actions would be required sooner under all inflow conditions to continue to maintain acceptable levels for salinity and water surface elevations within the Sea. This alternative would then involve acceleration to the year 2015 of a Phase 2 export to remove approximately 150,000 af/yr of Salton Sea water. Various Phase 2 export options are described in Section 2.6. Removal of this quantity of water per year from the Sea would result in a gradual decrease in the Sea's elevation.

Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 1

<u>Displacement Dike</u>: Alternative 1 with a reduction of annual inflows to 1.06 maf/yr would be the same as described above for current inflow conditions with the addition of a displacement dike to maintain elevations near target goals. This dike would be constructed in the southern portion of the Sea as shown on Figure 2.4-4. It is designed to essentially reduce the total area of the Sea, effectively displacing enough water to maintain elevations if annual inflows are reduced to 1.06 maf/yr. Construction activities for the displacement dike would temporarily disturb approximately 360 on-

shore acres, would take approximately 48 months to complete, involving a maximum of 300 to 330 workers. In-Sea area disturbed or occupied by new structures would total approximately 520 acres.

Borrow material would be obtained from the same locations used for construction of the evaporation ponds. The dedicated haul road would be extended along the west side of State Route (SR) 86 to the southern end of the Sea where it would proceed east to the mouths of the New and Alamo Rivers. A traffic control system would stop vehicles on the highway to allow the haul trucks to cross. Alternately, a bridge could be constructed to cross the highway at the same location. Once construction of the dikes is completed the haul road along SR 86 would be restored to pre-construction condition.

It is anticipated that, while some seepage into the area behind the dike may occur, evaporation would result in the area remaining dry most of the year. For the purposes of modeling the performance of alternatives, it has been assumed that this action could be taken as early as the year 2015.

Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2

Import from the Central Arizona Salinity Interceptor (CASI): In order to maintain target elevation goals, additional water must be delivered to augment reduced annual inflows to the Sea. This action would involve the import of water that originates as a brine stream from the proposed CASI, through Yuma to the Salton Sea. The CASI is designed to transport brackish water by gravity from the Tucson and Phoenix areas to Yuma. This water would be less saline, at approximately 4,400 mg/L, than the existing Salton Sea water and would help reduce salinity and stabilize elevation if annual inflows are significantly reduced. CASI water is expected to be available in approximately 25 years, with the current plans for its disposal including discharge to the Gulf of California. Approximately 300,000 af/yr are estimated to become available for diversion to the Salton Sea. This amount of CASI water could be conveyed continuously at approximately 420 cfs through a newly constructed canal to parallel the existing, All-American Canal.

CASI is proposed to to accomplish two things. First, CASI would transport brackish waters generated by municipal, industrial and agricultural sources away from the Tucson and Phoenix areas. Second, CASI would remove salt from the region brought in by the Colorado River water delivered to Phoenix and Tucson through the Central Arizona Project before the water is received by the municipal domestic water distribution system. If CASI water is not available as a replenishment source at the Sea, other sources of water would be sought as replacement for reduced inflows from current sources.

Reduction of Inflows to 0.8 maf/yr – Alternative 1: Phase 1

No additional actions are planned for Phase 1 since the 0.8 maf/yr inflow scenario is the same as the 1.06 maf/yr scenario during Phase 1, and, under the lowest inflow assumption, 0.8 maf/yr is not expected to be reached until well into Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 1: Phase 2

Flood Flows: In addition to those actions described above, Alternative 1 - Phase 2 actions with a reduction of inflows to 0.8 maf/yr would include augmenting inflow to the Sea by using flood flows from the Colorado River. Colorado River flood flows are generally available approximately every three to seven years. The variability and uncertainty of flood flows is discussed in sections 3.1 and 4.1 of this EIS/EIR.

Reclamation regulates discharges of Colorado River flood flows in coordination with the Corps of Engineers. While not considered as allocations of Colorado River water, these flows may be available to Colorado River water users or others provided they have the capability to capture, divert, and use this water when available. The All American Canal system could divert this water at Imperial Dam and convey the flood or anticipatory flood releases to the Salton Sea. When available, the floodwater flows would be conveyed through the existing facilities to either the Alamo River or the Coachella Canal and into the Salton Sea.

Use of these facilities may require improvements in the Alamo channel and some minor maintenance of evacuation areas along the Coachella Canal to the Salton Sea. The evacuation gates have sufficient capacity to carry approximately 700 cubic feet per second (cfs) that could be diverted at Imperial Dam and delivered through the All American Canal to the Coachella Canal and released through evacuation channels located at Detention Channel #1. Approximately 550 cfs could be diverted at Imperial Dam and delivered through the All American Canal and released through the Alamo River. Up to 300,000 af/yr or a total of 1250 cfs could be available during flood releases over a one to four month period.

2.4.3 Alternative 2

Current Inflow Conditions – Alternative 2: Phase 1

In addition to the common actions described in section 2.5, if current inflow conditions continue, Phase 1 actions would involve construction of an EES and the north wetland habitat.

Enhanced Evaporation System (EES): The EES is a method to remove salts from the Sea by increasing evaporation rates through spraying. Alternative 2 involves constructing tower modules on a site north of Bombay Beach to process 150,000 af/yr of Salton Sea water. The system would operate on average 18 hours per day and automatically shut down when winds exceed 14 miles per hour (mph). Each module would consist of a line of towers and precipitation ponds. A typical module configuration is shown on Figure 2.4-8.

The 80- to 130-foot high towers would be connected with hoses extending from the main line to the others through which water would be delivered. Nozzles attached to the hoses would spray Salton Sea water from a height sufficient to allow the water to evaporate and the salts or brines to precipitate into a catchment basin, and then be moved to precipitation ponds constructed below the towers.

The ponds are formed utilizing the natural topography and diking. The salt, approximately 9-10 million tons/yr, would be disposed of in-place in the final precipitation pond, through conventional landfill techniques. The ponds will be lined using techniques similar to those used for conventional landfills.

The intake structure for the system would be within the Sea, and would include a screened pipe approximately 87 inches in diameter. The horizontal intake structure would include a trash rack and fish screens. The buried pipeline would extend from the shoreline to the EES Bombay Beach site, under the existing railroad and Highway 111.

A total area of 17 square miles would be necessary for this alternative at this site. The Bombay Beach site includes a mix of federal government and privately owned lands, and the project would require some land acquisition. High power (230-kilovolt [kv]) electrical lines and towers traverse the site and would need to be relocated, in consultation with IID, at a distance from the EES. The location of the Bombay Beach site is shown on Figure 2.4-9.

North Wetland Habitat: The north wetland habitat would be constructed as described under Alternative 1 – Current Inflow: Phase 1.

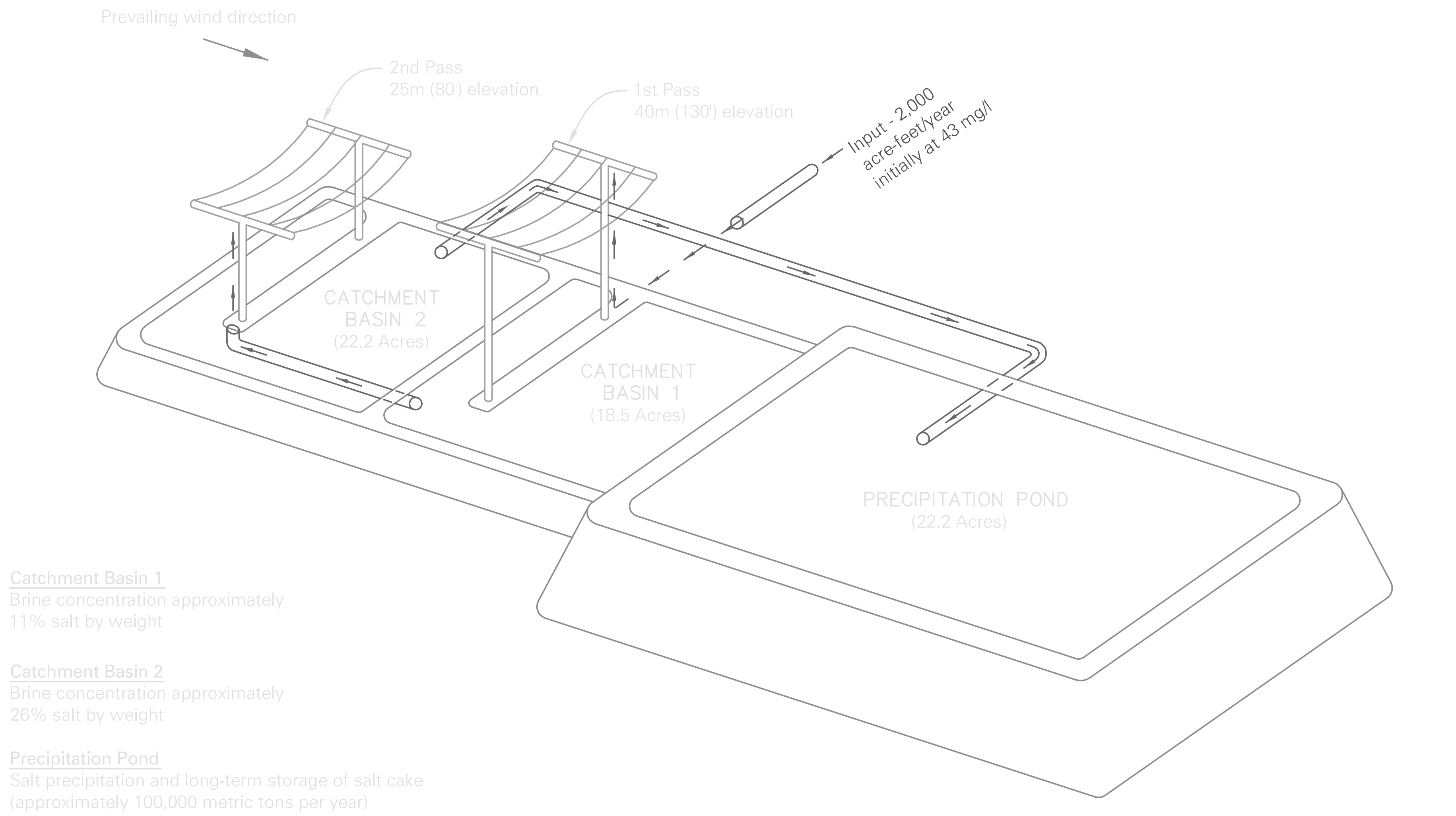
Current Inflow Conditions – Alternative 2: Phase 2

Under current annual inflow conditions, no additional actions would be needed during Phase 2 for Alternative 2.

Reduction of Inflows to 1.06 maf/yr – Alternative 2: Phase 1

With a reduction of annual inflows to 1.06 maf, Alternative 2 would initially be the same as described above for current inflow conditions. However, by about 2015, two additional actions designed to maintain the Sea's elevation would be initiated.

Displacement Dike: A displacement dike, as described under Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 1, would be constructed in the southern portion of the Sea as shown on Figure 2.4-4.



Source: Tetra Tech 1999

There would be approximately 75 modules in Phase 1 and 50 additional modules in Phase 2.

Typical Enhanced Evaporation System Module

Salton Sea Restoration Project

Figure 2.4-8

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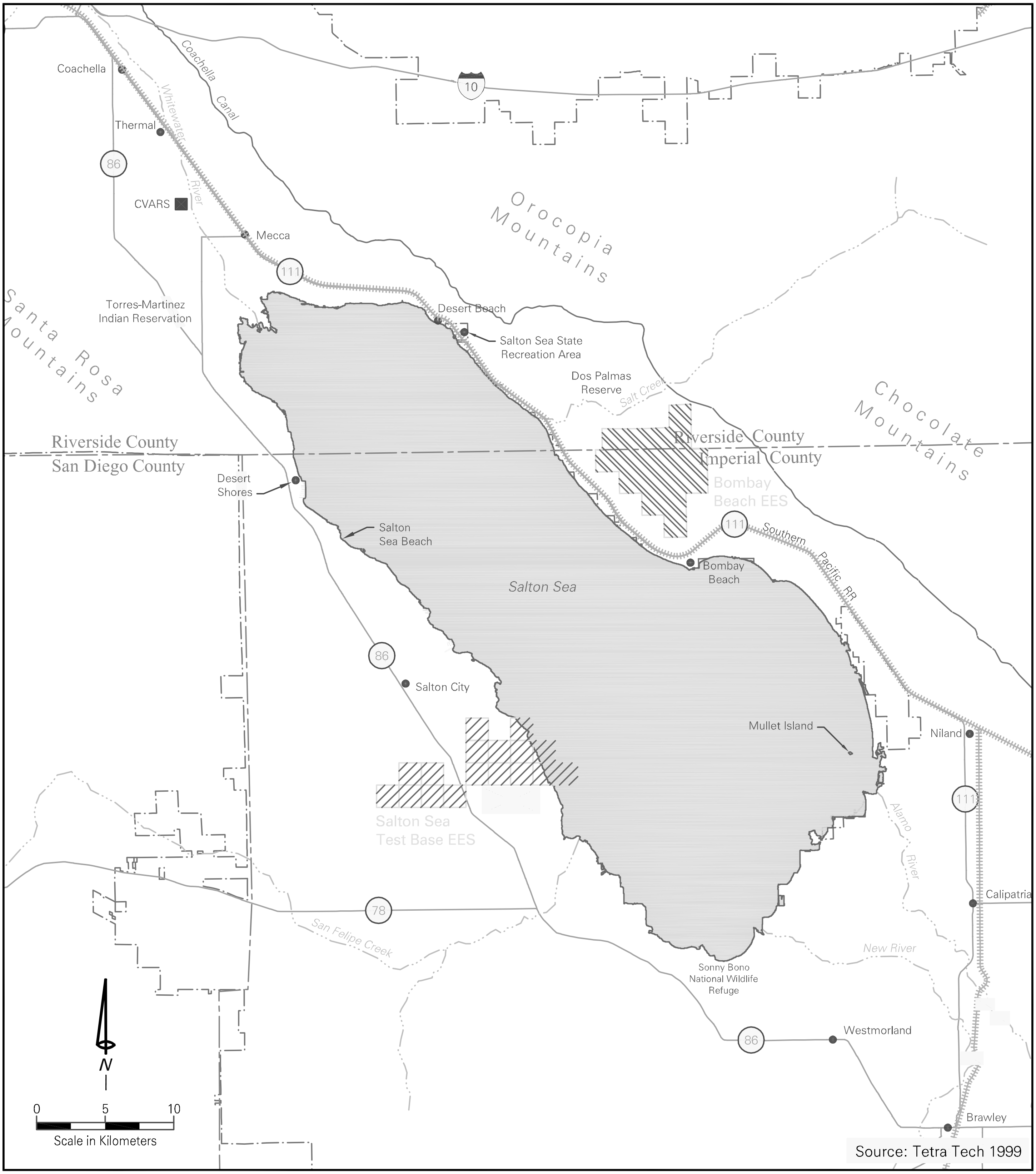


Legend

EES Location Used for Alternative 2

EES Location Used for Alternatives 3 and 4

EES at Bombay Beach and Salton Sea Test Base

Salton Sea, California

Figure 3

Flood Flows: At this same time, additional inflow to the Sea would come from periodic flood flows as described under Reduction of Inflows to 0.8 maf/yr – Alternative 1: Phase 2.

Reduction of Inflows to 1.06 maf/yr – Alternative 2: Phase 2

Import of Central Arizona Salinity Interceptor (CASI): Under reduced inflows to 1.06 maf/yr, Alternative 2 would require inflow of CASI water as described for Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 2: Phase 1

No additional actions are planned for Phase 1 since the 0.8 maf/yr inflow scenario is the same as the 1.06 maf/yr scenario during Phase 1, and, under the lowest inflow assumption, 0.8 maf/yr is not expected to be reached until well into Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 2: Phase 2

Alternative 2: Phase 2 with reduction of annual inflows to 0.8 maf/yr would be the same as that described for reduced inflows to 1.06 maf/yr - Phase 2. However, at approximately year 2060, additional displacement or inflow would be necessary to maintain salinity and elevation targets.

2.4.4 Alternative 3

All Conditions, Alternative 3: Phases 1 and 2

This alternative, located on the Salton Sea Test Base site, differs from Alternative 2 in location and quantity of land acquisition only. A smaller powerline also crosses a portion of this site and would likely need to be relocated. Most of the Salton Sea Test Base site is federal government property, but the property west of the test base and Highway 86 is a mixture of government and privately owned land, therefore additional property would need to be acquired. A total area of 17 square miles would be necessary for this alternative at this site to process 150,000 af/yr of Salton Sea water per year. The location of the EES Salton Sea Test Base site is shown on Figure 2.4-9.

2.4.5 Alternative 4

Current Inflow Conditions – Alternative 4: Phase 1

In addition to the common actions described in section 2.5, if current inflow conditions continue, Phase 1 actions would involve construction of an EES and an evaporation pond plus the north wetland habitat.

EES and Evaporation Pond: This alternative combines the technology of Alternatives 1 and 3 to increase the effectiveness and speed at which salts are removed from the Sea. The EES would be constructed on the Salton Sea Test Base site, but the size of the EES would be reduced to a capacity of 100,000 af/yr. The south evaporation pond and the pupfish pond would be constructed as described in Alternative 1. The evaporation pond would receive approximately 68,000 af/yr through pumping from the Sea.

Construction techniques for both the pond and the EES would be the same as for alternatives 1 and 3, respectively.

North Wetland Habitat: The north wetland habitat would be constructed as described under Alternative 1 – Current Inflow: Phase 1.

Current Inflow Conditions – Alternative 4: Phase 2

Expanded EES: With current annual inflows, Phase 2 of Alternative 4 would require an expansion of the EES capacity by 50,000 af/yr. The area necessary for the expanded system is contained within the original area shown for the Salton Sea Test Base site on Figure 2.4-9. Pipelines and intakes constructed during Phase 1 would be sufficient to carry the additional flows necessary to operate the expanded system under this alternative. The total number of EES line showers would be increased by two thirds and the quantity of water evaporated from 100,000 af/yr to 150,000 af/yr. Phase 1 units would continue to be operational and would require continued maintenance.

Reduction of Inflows to 1.06 maf/yr – Alternative 4: Phase 1

With a reduction of inflows to 1.06 maf/yr, Alternative 4 would initially be the same as described above for current inflow conditions. However, around the year 2015, two additional actions designed to maintain the Sea's elevation and protect nearshore habitat values would be initiated.

Displacement Dike: A displacement dike would be constructed in the southern portion of the Sea as described under Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 1.

Flood Flows: At this same time, additional inflow to the Sea would come from periodic flood flows, as described under Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2.

Reduction of Inflows to 1.06 maf/yr – Alternative 4: Phase 2

Import of Central Arizona Salinity Interceptor (CASI): Under reduced inflows to 1.06 maf/yr, Alternative 4 would require inflow of CASI water as described for Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2.

EES: With reduced inflows, Phase 2 of Alternative 4 would require continuation of Phase 1 EES at 100,000 af/yr capacity (as compared to a 150,000 af/yr capacity EES that would be required for Phase 2 at existing inflow levels). The area necessary for the expanded system is contained within the original area shown for the Salton Sea Test Base site on Figure 2.4-9. Pipelines and intakes constructed during Phase 1 would be sufficient to carry the additional flows necessary to operate the expanded system under this alternative. Phase 1 units would continue to be operational and would require continued maintenance.

Reduction of Inflows to 0.8 maf/yr – Alternative 4: Phase 1
No additional actions are planned for Phase 1 since the 0.8 maf/yr inflow scenario is the same as the 1.06 maf/yr scenario during Phase 1, and, under the lowest inflow assumption, 0.8 maf/yr is not expected to be reached until well into Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 4: Phase 2
Alternative 4, phase 2 with reduction of inflows to 0.8 maf/yr would be the same as that described for Reduction of Inflows to 1.06 maf/yr – Alternative 4: Phase 2.

2.4.6 Alternative 5

Current Inflow Conditions – Alternative 5: Phase 1
In addition to the common actions described in section 2.5, if current inflow conditions continue, Phase 1 actions would involve construction of an EES within an evaporation pond plus the north wetland habitat.

<u>EES within Evaporation Pond:</u> Under Alternative 5, the north evaporation pond would be constructed as described in Alternative 1. In addition, a 150,000 af/yr EES would be incorporated within the pond itself. The EES used in this alternative would involve technology typically used in artificial snowmaking. Instead of dropping water from the tower configuration described in Alternative 1, this method would use a series of portable, ground-based blowers. The blowers would use air to spray piped Salton Sea water up into the air above the evaporation pond.

<u>North Wetland Habitat:</u> The north wetland habitat would be constructed as described under Alternative 1 – Current Inflow: Phase 1.

Current Inflow Conditions – Alternative 5: Phase 2
<u>Export:</u> Under current annual inflow conditions, Alternative 5 would require an export to remove approximately 150,000 af/year of Salton Sea water to maintain target elevations. Various Phase 2 export options are described in Section 2.6.

Reduction of Inflows to 1.06 maf/yr – Alternative 5: Phase 1
With a reduction of inflows to 1.06 maf/yr, Alternative 5 would initially be the same as described above for current inflow conditions however, around the year 2015, two additional actions designed to maintain the Sea's elevation would be initiated.

<u>Displacement Dike</u>: A displacement dike, as described under Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 1, would be constructed in the southern portion of the Sea as shown on Figure 2.4-4.

<u>Flood Flows</u>: At this same time, additional inflow to the Sea would come from periodic flood flows as described under Reduction of Inflows to 0.8 maf/yr – Alternative 1: Phase 2.

Reduction of Inflows to 1.06 maf/yr – Alternative 5: Phase 2

Import of Central Arizona Salinity Interceptor (CASI): Under reduced inflows to 1.06 maf/yr, Alternative 5 would require inflow of CASI water as described for Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 5: Phase 1

No additional actions are planned for Phase 1 since the 0.8 maf/yr inflow scenario is the same as the 1.06 maf/yr scenario during Phase 1, and, under the lowest inflow assumption, 0.8 maf/yr is not expected to be reached until well into Phase 2.

Reduction of Inflows to 0.8 maf/yr – Alternative 5: Phase 2

Alternative 5, phase 2 with reduction of inflows to 0.8 maf/yr would be the same as that described for reduced inflows to 1.06 maf/yr - Phase 2. However, at approximately year 2060, additional displacement or inflow would be necessary to maintain salinity and elevation targets.

2.5 COMMON ACTIONS

2.5.1 Overview

The following actions are common to all alternatives described in the previous section. Taken together these common actions, integrated with one of the alternatives described above, define plans that partially address the project's multiple goals and objectives. These initial actions will help halt further degradation of the Sea and will be supplemented by later actions developed under the adaptive management efforts of the Restoration Plan. Pilot projects are planned for each common action to finalize the specifications of each action and test its effectiveness. Because these pilot projects are likely to be implemented prior to publication of the Final EIS/EIR, separate environmental reviews will be conducted for each action, as necessary.

2.5.2 Fish Harvesting

Tilapia, feeding on benthic organisms, accumulate nutrients in the form of body mass throughout their lives. These nutrients are ultimately returned to the environment through death and decay. Harvesting tilapia is being considered as a method to reduce the internal nutrient load and fish population densities within the Salton Sea. In addition to reducing nutrient loads, reducing tilapia densities is expected to provide a healthier environment for the fishery and could improve the health of the tilapia population. Fish harvesting also provides a local industry. Tilapia would be commercially harvested and processed for marketable fertilizer or fish meal.

Boat dock facilities and a processing plant could be at one of several locations along the shore of the Salton Sea, including the Salton Sea Test Base or on Torres Martinez Indian Reservation lands. Figure 2.5-1 shows a conceptual design for a pier and appurtenant facilities to be located on the south corner of the northern evaporation pond within the Salton Sea Test Base site. If the evaporation ponds are not constructed, the pier could be at the site of the abandoned Navy pier along the diked area adjacent to the test base encampment area. The pier would be constructed to accommodate four berths, but only two berths would be used for harvesting fish; the other two berths would accommodate shoreline and nearshore cleanup operations.

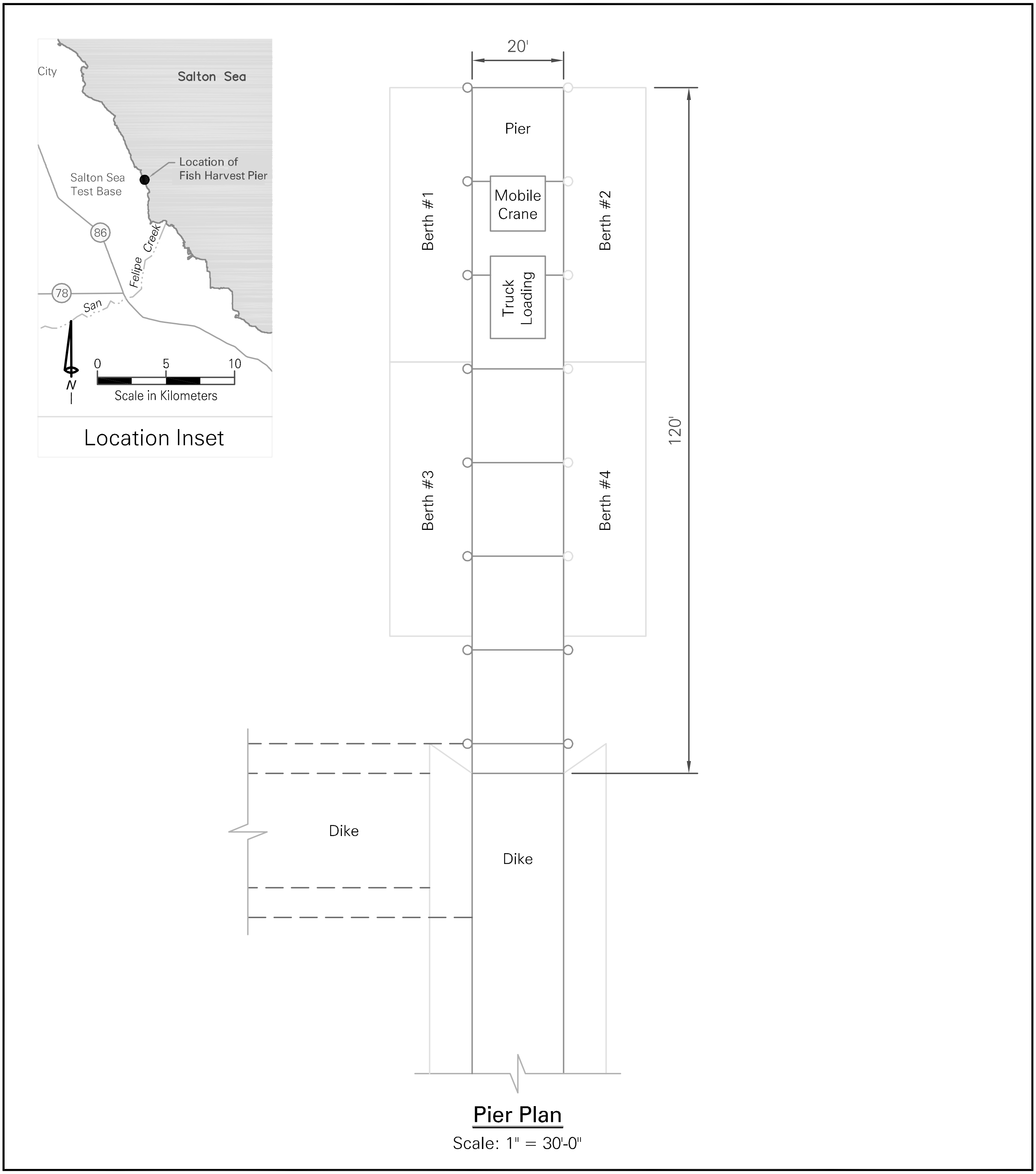
The facilities would cover approximately two acres and would include a 150-foot by 20-foot pier, capable of supporting the weight of a loaded dump truck and mobile crane, and a pier access road. A grinder facility would be required and would consist of a conveyor and loading hopper, grain silo, storage bins, diesel fuel storage, administrative and maintenance building, open storage space, and support equipment. The support equipment would include two commercial fishing boats, a mobile pier crane, dump trucks, front-end loader, maintenance truck, tub grinder, wash rack, and administrative vehicles.

Fish harvesting would involve diesel-powered fishing boats netting tilapia and transporting them to the pier, where the catch would be offloaded onto dump trucks by a mobile crane. The dump trucks would haul the fish to a tub grinder to be ground into fish meal or fertilizer, which would be transported to a silo using a conveyor system and stored until taken to an off-site processing plant. Dump trucks used to transport the fish would be washed down daily at a wash rack equipped with containment berms and an oil/water separator. The wastewater from the wash rack would be processed through a sewer system.

2.5.3 Improved Recreational Facilities

There are numerous public boat ramps around the Salton Sea that are in need of repairs. The main concerns are safety and usability, as some of the ramps require major rehabilitation. Some of the ramps have cracks and holes, several should be widened, and some should be replaced entirely. Some minor dredging will be required to provide access from most of the boat ramps to the water. Breakwaters or jetties may need to be constructed to block the movement of sand in front of the ramps. Some channelization may be required to provide deeper water for the boats where the seabed is too flat.

Major boat ramp rehabilitation would involve one-time dredging of approximately 10,000 cubic yards of material within about three acres of the Sea per ramp, with a temporary surface disturbance of approximately three acres. The workforce necessary for this task at each boat ramp is estimated to be three to six people, and the job would take about 90 days. Minor boat ramp rehabilitation would involve dredging approximately 5,000 cubic yards of material within about two acres of



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Fish Harvesting/Shoreline Cleanup Pier Plan

Salton Sea, California

Figure 2.5-1

the Sea per ramp; temporary surface disturbance would involve approximately two acres. The construction work force would be three to six people, and construction would take approximately 90 days.

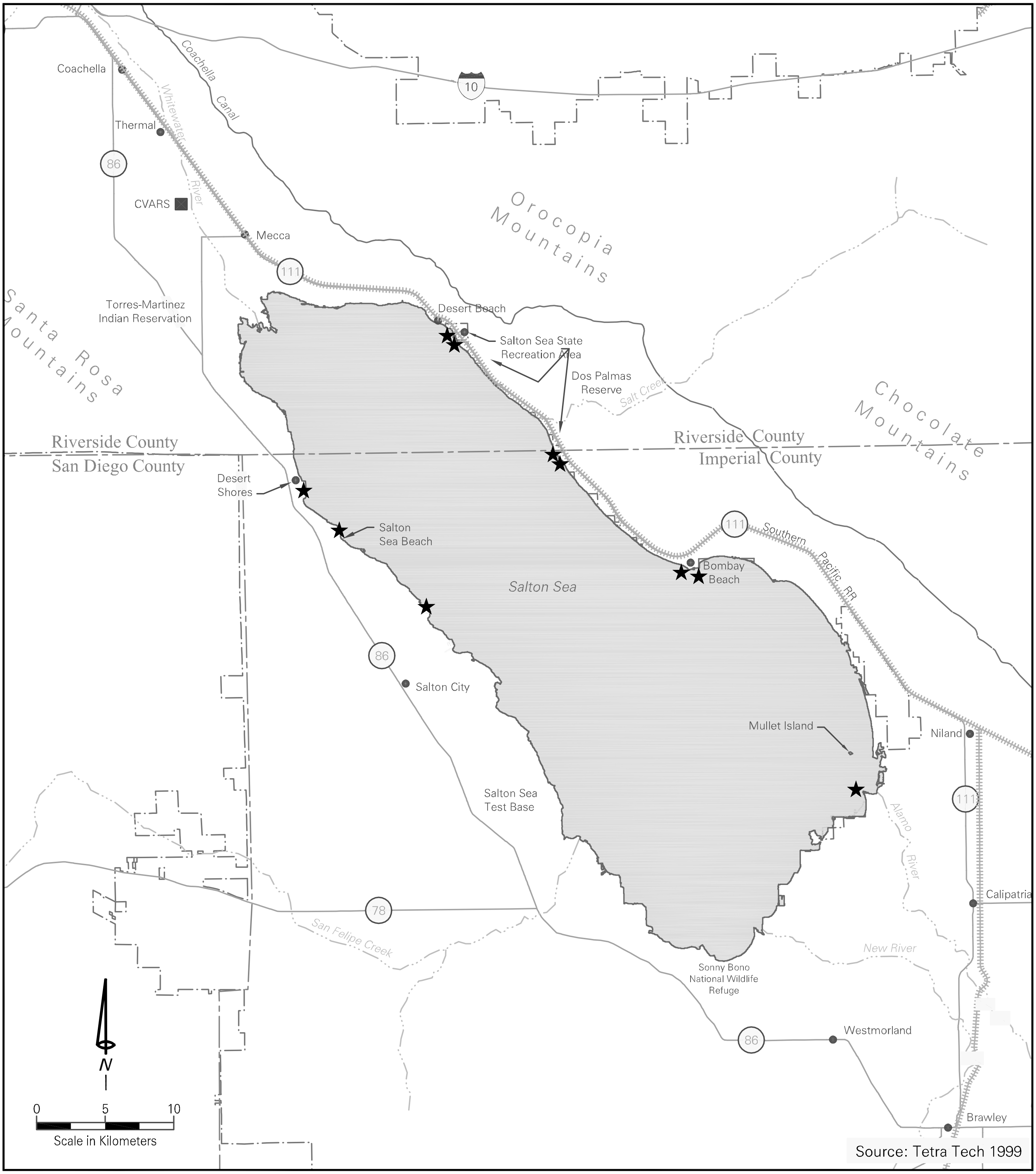
Boat ramp access roads are also in need of repairs. Many of the roads need patching, oiling, or resurfacing. Some of the roads are in very poor condition and need to be rebuilt. Major road reconstruction per ramp would involve temporarily disturbing the surface of approximately six acres and would involve four to eight workers over a period of about 90 days. Minor road rehabilitation per ramp would include patching, oiling, and/or chipping and sealing and would temporarily disturb the surface of approximately three acres. The workforce would include four to eight workers over a period of about 90 days. Construction traffic for all boat ramp and access road work would require temporary closures and detours until work is completed. Energy requirements are expected to be minimal. Rehabilitated boat ramps would be designed to operate within the elevation range expected under the selected alternative. Locations of existing public boat ramps and access roads are included on Figure 2.5-2.

2.5.4 Shoreline Cleanup

A shoreline cleanup program would consist of removing dead fish on the water surface and on the shoreline. Removing the fish would reduce odors and nutrients from the Sea. The Sea cleanup operation would use skimmer barges to retrieve fish floating on the water surface. The skimmer barges would have conveyor systems to pick up the dead fish and load them onto the barge. A minimum of two skimmer barges would be needed, one with a deep draft that could handle rough seas and one with a shallow draft that could get in close to the shoreline. Each barge would have a 50- to 60-ton haul capacity. Since similar facilities would be required for shoreline cleanup and fish harvesting activities, shared facilities would be constructed. (See the discussion on fish harvesting for details on the dock and appurtenant facilities.) In addition, an incinerator and holding bins would be constructed to support cleanup activities. The fish and other material collected from cleanup operations would be incinerated before being deposited in a landfill.

The beach cleaning equipment would involve a conveyor system that rakes the beach. The rake has hundreds of tines, mounted in offset rows, that rake the sand and remove broken glass, plastic, cigarette butts, straws, cans, half-inch to four-inch diameter stones, fish, fish bones, and small pieces of wood. The hopper capacity is one and a half-cubic yards. The tractor and rake can cover three to five acres per hour.

Shoreline cleanup would be conducted at public access locations, including but not limited to the Salton Sea Recreational Area, Sonny Bono National Wildlife Refuge, Bombay Beach, Desert Beach, Salton Sea Beach, Mecca Beach, Desert Shores, Salton City, and Niland.



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Legend

★ Public Boat Launches

Existing Public Boat Docks

Salton Sea, California

Figure 2.5-2

2.5.5 Integrated Wildlife Disease Program

Bird and fish mortality at the Salton Sea can result in high profile events requiring rapid response actions. The ability to minimize losses from the various causes of disease depends on several factors, including early detection of outbreaks, timely, accurate diagnosis of the disease agent involved, appropriate response actions, and monitoring during the course of the event to determine if adjustments to response actions are needed. In the past, these principles have not been applied routinely at the Salton Sea due to lack of resources. However, the increasing frequency of bird die-offs during recent years and the severity of these losses demand increased efforts to reduce the number of bird deaths while solutions are being sought for restoring the health of this ecosystem.

An integrated, multi-agency effort involving the National Wildlife Health Center of the US Geological Survey (USGS), the USFWS, the Salton Sea Authority, and CDFG is intended to address this need. The Salton Sea Authority would provide field technician-level support for on-site methodical monitoring for wildlife die-offs at the Sea, response assistance, biological sample collection, and scientific information compilation relative to wildlife mortality at the Sea.

The National Wildlife Health Center will provide scientific oversight for the effort and will contribute resources by conducting diagnostic evaluations, including specimen processing in response to mortality events and by training technical support personnel. The center also will conduct field investigations, as warranted, regarding bird mortality events, will provide technical advice to the USFWS on disease control actions, and will participate in such activities to the extent warranted. USFWS will provide office space at the National Wildlife Refuge and some logistical support for the technical personnel. CDFG will provide diagnostic support for evaluating the causes of fish die-offs and will participate in combating major bird die-offs.

The program will provide support for a full-time field technician and for processing diagnostic samples that require special assays outside the scope of routine diagnostic capabilities or that significantly increase the caseload of the National Wildlife Health Center and CDFG. In addition, resources will be provided for supplemental field support for the technician, possibly through the Torres Martinez Indian Tribe. The technician and the National Wildlife Health Center will train such individuals to participate at the level needed.

2.5.6 Long-term Management Strategy

The Salton Sea Restoration Project could include both construction and management actions that would involve:

- Long-term operation and maintenance requirements;
- Scientific investigations of ecological conditions and relationships that either exist or develop in the Sea;
- Monitoring to determine the effectiveness of the actions implemented; and

- Potential opportunities to modify the actions to improve their effectiveness in meeting Project goals.

When a Project is recommended, a long-term management plan would be developed. The management plan would define activity coordination, project operational responsibilities, scientific research and monitoring responsibilities, and resource protection and management. The plan would be based on the concept that management is adaptable, given the recognized unknowns that exist in the Salton Sea ecosystem and the need for operational flexibility to respond to future monitoring and research findings and varying resource conditions. Physical and economical conditions would be considered in any proposed modification to project operation or implementation of any additional restoration measures. The plan would be designed to strengthen the restoration effort and to better meet the purpose and need of the project.

Consultation would be maintained with agencies of the Federal government (including the USFWS, the Bureau of Indian Affairs, and EPA), California state resource agencies, the California Regional Water Quality Control Board, affected tribal organizations, and with the general public, including representatives of academic and scientific communities, environmental organizations, and the recreation industry. The plan would define opportunities for information exchange and involvement by all parties.

A management work group would be selected by the lead agencies, and would include tribal representation. The management work group would make recommendations and facilitate consultation with all stakeholders and interested parties. The work group would be responsible for refining the goals defined in this EIS/EIR, defining management plan policy, preparing a final management plan (based upon the final decision and Congressional authorities), defining conditions needed for modifying operating criteria and other resource management actions and direction, and for overseeing and coordinating the implementation of the various components of the approved action (including construction, operations, mitigation, monitoring, and new investigations).

An additional critical role of the management work group is to coordinate the continued implementation of the selected action with other actions, identified in the discussion of cumulative effects, which may have positive or negative effects to the goals of this program. Opportunities for future cooperation with other entities such as state agencies (for example, CRWQCB for implementation of TMDLs) or local entities, such as IID for drainage management, in terms of timing, management, and perhaps funding can be investigated.

Finally, as the management program develops, adaptive management principles would be applied by the work group to assure that the management decisions made under conditions of uncertainty be monitored and evaluated in a scientifically sound manner for their effectiveness in attaining defined project goals.

The management work group would also coordinate the implementation of the Strategic Science Plan (see Section 2.5.7). The Science Plan, drafted by the science sub-committee, defines the long-term science needs and recommends effective management of the scientific effort into the future. The plan would include a scientific staff and monitoring and research activities (designed by qualified scientists) in direct response to commitments identified in the Record of Decision (ROD) and to the needs of management agencies. The Science Plan would be an integral part of planning and evaluation. A process would be developed to assure funding, to coordinate and communicate management agency needs to researchers, to develop recommendations for decision-making, and to transfer new scientific information to the management agencies. Independent, external review processes would be critical to this science component, and the scientific effort may be further enhanced by various technical working groups, an on-sea common use field station, and a coordinated database. It is critical to the process that the science staff is both independent of the management work group and yet responsive to their needs.

A critical role for the science staff would be to facilitate the development of a conceptual model of the Salton Sea ecosystem, providing a common frame of reference for scientists, stakeholders, and the interested public, and guiding long-term monitoring and focused investigations. This conceptual model would be an early priority of the science staff and would be a working tool, emphasizing processes rather than details. As information is developed and relationships are defined, quantitative models of the relationships defined in the conceptual model would be developed for predicting ecosystem responses to specific restoration actions.

2.5.7 Strategic Science Plan

The strategic science plan would include the following components:

- Conceptual modeling to guide both long-term monitoring and focused studies toward goals and objectives identified for the project;
- Monitoring to evaluate the success of restoration actions and to collect long-term data from which quantitative models could be validated;
- Quantitative modeling to generate hypotheses about these processes and ecosystem functions, which focused investigations then would explore;
- Focused investigations to fill in key information gaps, to support monitoring by identifying important measures that were not initially recognized, and to help in validating quantitative models;
- Technical assistance to involve time-responsive short-term needs, such as consultations, data synthesis and evaluation, and other scientific evaluations to guide management response and actions; and
- Data management to help integrate data among monitoring, focused investigations, modeling, and management.

This program would allow managers to adapt restoration actions to future ecological needs and assure scientific evaluation is an integral part of adaptive management. "Adaptive management" frequently is cited as an effective approach to managing natural systems; however, the term is widely misunderstood, and rarely is it actually undertaken. Under adaptive management, scientists design restoration actions and monitor the results, which restoration managers then use to make needed adjustments. Adaptive management works best if scientists design restoration experiments whose outcomes can be predicted and then measured. Restoration managers could then examine the scientists' models, apply them to the problems they face, and send the models back to the scientists for fine-tuning.

The Executive Summary of the Strategic Science Plan is provided in Appendix B.

2.6 PHASE 2 EXPORT AND IMPORT OPTIONS

These actions have been developed on a programmatic level; thus, descriptions provided represent typical alignments and pipeline details that could be used. These actions, taken in conjunction in conjunction with Phase 1 actions, would be intended to provide long-term solutions to the problems at the Sea. Because none of these Phase 2 actions would be constructed for at least 15 to 30 years, detailed analyses of potential environmental consequences are not currently feasible. The joint leads plan to continue to develop and refine these actions. Once specifics are determined, additional environmental analysis would be performed. The actions discussed below are included as part of the larger alternatives presented in Section 2.4.

2.6.1 Export Options

Export of water from the Sea is included as an accelerated Phase 2 action as part of Alternative 1, if current average annual inflows continue. The following export options are being considered for this alternative.

Expanded EES

The large EES facility would be an expansion of the EES facility constructed during Phase 1. The area necessary for the expanded system is contained within the original areas shown on Figure 2.4-9. Pipelines and intakes constructed during Phase 1 to support alternative 2, 3, or 4 would be sufficient to carry the additional flows necessary to operate the expanded system under this alternative. The total number of modules would be increased by two thirds, and the quantity of water would be increased from 150,000 af/yr to 250,000 af/yr. Phase 1 units would continue to be operational and would require continued maintenance.

Export to Gulf of California

This action would involve pumping water directly out of the Salton Sea to the Gulf of California through an enclosed pipeline. The pipeline would terminate south of either Golfo de Santa Clara on the east or San Felipe on the west, immediately outside of the United Nations-designated biosphere. Alternately, the outfall structure could be extended approximately a mile into the Gulf of California. The screened intake structure would use the same design as that described for the EES and would be offshore of the Salton Sea Test Base site. The 112-inch diameter pipeline or canal would convey 250,000 af/yr of water, or 345 cfs, and would be constructed of polymer-lined steel. The pipeline route would extend 140 miles and would require two pumping stations to lift the water 453 feet. General pipeline alignments are indicated on Figure 2.6-1.

Export to Pacific Ocean

This action would involve pumping water directly out of the Salton Sea to the Pacific Ocean through an enclosed pipeline and tunnel that would terminate in Oceanside. The screened intake structure would use the same design as that described for the EES and would be offshore of the Salton Sea Test Base site. The 112-inch diameter pipeline would convey 250,000 af/yr, or 345 cfs, and would be constructed of polymer-lined steel. General pipeline alignment is indicated on Figure 2.6-1.

Export to Palen Dry Lakebed

This action could be implemented using either one of two approaches. Water could be pumped directly out of the Salton Sea or pumped as concentrated brine water to Lake Palen lakebed through an enclosed pipeline. If the water is pumped directly from the Sea, the screened intake structure would use the same design as that described for the EES. The intake would be located offshore of the Bombay Beach site. A 112-inch diameter pipeline would convey 250,000 af/yr (about 345 cfs) of water, and would be constructed of polymer-lined steel. If water is pumped as brine, it would most likely be pumped from an evaporation pond. General pipeline alignment is indicated on Figure 2.6-1.

2.6.2 Import through Yuma, Arizona

This action would involve the import of water that originates as a brine stream from the proposed CASI, through Yuma to the Salton Sea. The CASI is designed to transport brackish water by gravity from the Tucson and Phoenix areas to Yuma. This water would be less saline, at approximately 4,400 mg/L, than the existing Salton Sea water and would help reduce salinity and stabilize elevation if annual inflows are significantly reduced. CASI water is expected to be available in approximately 25 years, with the current plans for its disposal including discharge to the Gulf of California. Approximately 304,800 af/yr are estimated to become available for diversion to the Salton Sea. This amount of CASI water could be conveyed continuously at approximately 420 cfs through a newly constructed canal to parallel the existing, All-American Canal. Additional discussion of CASI is provided in section 2.4.2 under Reduction of Inflows to 1.06 maf/yr – Alternative 1: Phase 2.

2.7 PROJECTS INCLUDED IN CUMULATIVE IMPACT ANALYSIS

2.7.1 Overview

The CEQ regulations that govern the preparation of environmental impact statements provide that where federal actions would generate “cumulative impacts,” those impacts should be considered in relevant EISs (40 CFR 1508.25 [1988]). CEQA Guidelines (section 15130) require that cumulative impacts must be discussed when they are cumulatively considerable. The cumulative analysis evaluates a particular project viewed over time and in conjunction with other related past, present, and reasonably foreseeable future projects whose impact might compound or interrelate with those of the project at hand. The cumulative impact analysis presented here is prepared in response to this regulatory requirement. "Cumulative impact" is defined as the impact on the environment that results from the action when added to other past, present, and probable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7 [1988]).

In order to analyze cumulative effects, a region must be identified in which effects of restoration activities and other past, proposed, and reasonably foreseeable actions would be recorded or experienced. The cumulative effects region for Phase 1 restoration activities is generally defined as the Salton Sea watershed. It is defined as the entire watershed in order to identify and consider activities that may occur in the upper reaches of the watershed but that still could affect the objectives of the restoration activities (for example, implementing water quality improvement programs or water transfers).

The projects considered in the analysis of cumulative effects cover a broad range of regional and local actions. The list of projects (Table 2.7-1) has been developed with a focus on those that would have the most potential to have cumulative effects when combined with Phase 1 actions. Additional projects may be added in supplemental documents that are prepared to support decisions on Phase 2 actions.

Table 2.7-1 shows the resource areas that could potentially be affected by each project. The greatest probability that any given project would have cumulative effects would occur if the project could potentially cause some change to the future inflows to the Sea. With the competing demands for water in California, it is most likely that the cumulative effects of almost any combination of the projects listed in Table 2.7-1 would be a future reduction of inflows to the Sea. Rather than attempt to forecast the individual effects of each project, two reduced inflow scenarios have been evaluated for all alternatives including the No Action Alternative. These reduced inflow scenarios account for long term reductions to

Table 2.7-1
Summary of Resources Potentially Impacted by Cumulative Actions

	Environmental Resources																	
Cumulative Action	**Surface Water**	**Ground Water**	**Geology and Soils**	**Air Quality**	**Noise**	**Fisheries and Aquatic**	**Avian**	**Vegetation and Wildlife**	**Socioeconomics**	**Land Use**	**Agriculture**	**Recreation**	**Aesthetics**	**Public Health**	**Utilities**	**Cultural**	**Indian Trust**	**Environmental Justice**
California 4.4 Plan	X	X							X	X	X						X	X
Imperial Irrigation District Water Transfer Program	X	X							X	X	X							X
All American and Coachella Canal Lining Projects	X	X							X		X							
Total Maximum Daily Load Program	X					X					X							
Mexicali Wastewater System Improvements	X	X												X	X			
West Mojave Coordinated Management Plan						X	X	X		X								
Coachella Valley Multiple Species Habitat Conservation Plan						X	X	X										
Northern and Eastern Colorado Desert Coordinated Ecosystem Management Plan						X	X	X		X								
Lower Colorado River Desert Region Plan	X	X	X	X		X	X	X		X	X						X	
Colorado River Basin Watershed Management Strategy	X	X				X	X	X		X	X	X	X	X				
Coachella Valley/Salton Sea Nonpoint Source Project	X	X				X	X	X		X		X		X			X	
Coachella Valley Water Management Plan	X	X							X									
Mesquite Regional Landfill	X	X	X	X	X				X	X			X	X				
Newmont Gold Company's Expansion of the Mesquite (Gold Field) Gold Mine	X	X	X	X	X				X	X								
Gateway of the Americas Specific Plan as the New Port of Entry									X	X					X			X
Heber Wastewater Treatment System Project	X	X					X							X	X			
Drain Water Quality Improvement Plan—Imperial Irrigation District	X	X								X	X			X				
Dos Palmas Habitat Restoration/Enhancement						X	X	X		X		X						
Caltrans: Route 86 Expressway Mitigation						X	X	X										
Coachella Valley National Wildlife Refuge—Salt Cedar Removal								X										
Lewis Drain Treatment Facility	X	X									X							
Peach/Pampas Watershed Study	X	X									X							
Duck Club Evaporative Ponds	X	X									X							
Brawley, California Wetlands Project	X	X				X	X	X			X							
Whitewater River Flood Control Project	X									X				X				
Colorado River Basin Salinity Control Program	X	X								X	X							

the inflows to the Sea that could occur if a number of the projects listed in Table 2.7-1 are implemented. Within each resource discussion in chapter 4, the effects of both reduced inflow scenarios have been discussed for each alternative. These discussions in essence address the cumulative effects of any number of projects that could cause reductions to the inflows to the Sea. In addition, a discussion of any other specific cumulative effects is included near the end of each resource section in chapter 4. Environmental documentation prepared for any of the projects considered in the cumulative analysis is expected to include any specific impacts that project would have on the Salton Sea.

2.7.2 California 4.4 Plan

The rights of the Colorado River seven states (including California) and Mexico to use Colorado River water is governed by a body of permits, agreements, contracts, court decrees, acts, laws, and treaties collectively referred to as the "Law of the River" or "Colorado River Law." California's entitlement to divert and consumptively use Colorado River water under the Law of the River is 4.4 maf/yr, and 50 percent of any surplus water in any one year. The water use of the water has been allocated by Supreme Court decrees, the California Seven-Party Agreement, contracts with the Secretary of the Interior, and agreements among water entitlement holders.

Both Arizona's and Nevada's water uses are increasing and they will likely be fully using their Colorado River water entitlements in a few years, which will reduce the amount of water available to California. The Secretary of the Interior has requested that the Colorado River water users in California develop a plan to reduce their use of Colorado River water to within California=s basic entitlement.

Under the California 4.4 Plan framework, the Colorado River Board of California, the water users, and other interested parties will establish and agree on strategies by which California's consumptive use of Colorado River water would be reduced over time to its basic apportionment of 4.4 maf/yr and 50 percent of any surplus water. This would be accomplished in phases, by water conservation, conveyance system improvements, water transfers, banking water, and the establishment of water budgets among those users who share an entitlement. The objective is to allow California time to reduce its use of Colorado River water as the states of Arizona and Nevada grow into their full use of their Colorado River water apportionments. Some of the actions contemplated would likely result in reduced irrigation drainage flowing to the Salton Sea.

2.7.3 Imperial Irrigation District Water Transfer Program

Depending on local conditions, San Diego County obtains up to 95 percent of its water from the MWD, which imports water from the Colorado River and receives water delivered by the Department of Water Resources through State Water Project facilities pursuant to Metropolitan's State Water Project Contract. The San Diego County Water Authority (SDCWA) has negotiated an agreement for the long-term transfer of conserved water from the Imperial Irrigation District (IID). Under the proposed contract, IID customers would undertake water conservation efforts to reduce the use of Colorado River water within IID. Water conserved through these efforts would be transferred to SDCWA. Since the production of conserved water will depend on the level of voluntary landowner participation, the agreement does not specify an amount of water to be transferred. The agreement instead sets the transfer quantity at a maximum of 200,000 af/yr. The initial transfer quantity would be 20,000 af for the first year, with a build up of 20,000 af/yr thereafter for ten years or until the transfer amount is reached. An additional 100,000 af/yr of conserved water may be made available in the future to Coachella Valley Water District (CVWD).

The initial transfer target date is 2002 or whenever the conditions necessary for the agreement to be finalized are satisfied or waived, whichever is later. The initial term of the transfer agreement is 45 years from the effective date (after certain conditions are satisfied or waived) with a 30-year renewal option. These agreements could play a significant role in helping the Colorado River Board develop a plan that allows California to live within its 4.4 maf/yr water entitlement from the Colorado River.

The IID Water Transfer Environmental Impact Statement/Environmental Impact Report (EIS/EIR) will analyze options for conserving and transferring water. It is believed that at least one option will be on-farm conservation, another includes system improvements, which may include such improvements as lateral interceptors. On-farm conservation improvements such as pump-back systems could result in significant reductions of water to the Salton Sea. In a worst case scenario for the Salton Sea, for every one acre-foot conserved via a pumpback system could be one acre-foot transferred by the farmers. On-farm conservation would most likely result in increased concentrations of salts, selenium and other constituents remaining in the drains. As tail water is "conserved", tile water will make up a greater portion of total flows to the drains and the Sea. Other alternatives may have less harmful impacts on surface waters, such as conversion of land to less water intensive use (e.g. intermittent wetlands), temporary fallowing to finance pumpback systems and, of course, the no action, alternative. The IID/San Diego Transfer EIS is in the early stages of development and there will continue to be close coordination between the lead agencies.

2.7.4 All American and Coachella Canal Lining Projects

The All American Canal diverts approximately 3.4 maf/yr from the Colorado River for use in the Imperial and Coachella valleys. Approximately 100,000 af/yr seeps into the ground along unlined portions of the system. Public Law 100-675, approved on November 17, 1988, authorized the Secretary of the Interior to reduce the seepage of this water by implementing actions with non-Federal funds. Chapter 7 to Part 5 of Division 6 of the California Water Code appropriates money from the State's General Fund to finance and arrange for lining portions of the All American Canal and the Coachella Canal. In addition, California State Senate Bill 1765 provided specific funding to line portions of the system after a seepage study has been conducted. The seepage study was designed to determine the nature of subsurface and drainage canal water movements from the unlined canals to the Salton Sea and to existing wetlands adjacent to the Coachella Branch. The study (Tetra Tech 1999) used a numerical model to predict the amount of water that may be lost to the Salton Sea and nearby wetlands due to the canal lining projects. The seepage losses are thought to be somewhat uncertain due to the large distance and travel time from the canals. The reduction in seepage to the Salton Sea may range from 3,000 to 23,000 af/yr.

A Final EIS/EIR prepared by Reclamation in 1994 calls for lining a 23-mile section of the All American Canal to conserve approximately 67,700 af/yr of water. The ROD prepared by Reclamation in 1994 approved this preferred alternative. A Draft EIS/EIR prepared by Reclamation in 1993 calls for lining a 33.4-mile section of the Coachella Branch to conserve approximately 25,680 af/yr of water after providing water for wetlands mitigation. The canal lining projects are projected to be completed in 2006 (Chapter 7 to Part 5 of Division 6 of the California Water Code).

2.7.5 Total Maximum Daily Load Program

Congress, through the CWA, established the legal requirement that States list and rank impaired waterbodies, and that TMDLs be established for those waterbodies, in accordance with the priority ranking. Pursuant to the requirements of CWA §303(d) and 40 CFR 130.7, the CRWQCB – CRBR identified impaired waters.

Upon approval of the TMDLs by EPA, the State is required to incorporate the TMDLs, along with appropriate implementation measures, into the State Water Quality Management Plan. This is equivalent to a Basin Plan Amendment. CWC 13242 requires that a program of implementation for achieving water quality objectives be included in any Basin Plan Amendment. Pursuant to these requirements, the Regional Board will develop and adopt Implementation Plans for each TMDL for each listed water body/pollutant combination. Implementation Plans must include a description of actions necessary to achieve WQOs, a time schedule for actions to be taken, and a description of monitoring and surveillance activities to determine compliance with the objectives. The Regional Board will likely consider technical and economic feasibility when adopting the TMDL Implementation Plans. The Implementation Plans will utilize an adaptive management approach.

Although salt is listed as a constituent impairing the Salton Sea, the Regional Board, through its total dissolved solids (TDS) water quality objective for the Salton Sea, recognized that due to the "difficulty and predicted costliness of achieving stabilization of the Salton Sea, it is unreasonable for the Regional Board to assume responsibility for implementation of this objective." It is CRWQCB – CRBR's position that restoration of the Sea with respect to salt cannot be achieved through the TMDL process alone.

The CRWQCB – CRBR has identified quality limited waters including the New River, Alamo River, Imperial Valley Drains, Salton Sea, Palo Verde Outfall Drain, and Coachella Valley Stormwater Channel. The Salton Sea Watershed has also been identified as a priority watershed. CRWQCB is currently in the process of establishing TMDLs for these waters, as listed in Table 2.7-2. A TMDL implementation plan that is economically reasonable and technically feasible will be developed as part of this process. The long-term goal of the TMDL process will be to improve the quality of waters flowing into the Sea.

Table 2.7-2
Timeline for TMDLs

Waterbody	Priority	Pollutant	Start Date	Completion Date
New River	High	Silt	1998	2002
		Bacteria	1998	2005
		Nutrients	2002	2010
		Pesticides	2002	2013
		VOCs	2007	2013
Alamo River	High	Silt	1998	2000
		Selenium	2000	2010
		Pesticides	2002	2011
Imperial Valley Drains	High	Silt	1998	2000
		Selenium	2000	2010
		Pesticides	2005	2011
Salton Sea	Medium	Silt	1998	2001
		Selenium	2002	2007
		Nutrients	2002	2010
Palo Verde Outfall Drain	Medium	Bacteria	2005	2011
Coachella Valley Stormwater Channel	Low	Bacteria	2005	2011

2.7.6 Mexicali Wastewater System Improvements

Untreated or partially treated wastewater from Mexicali, Mexico, currently is discharged into the New River, which flows north into the United States and ultimately empties into the Salton Sea. The United States and Mexico, through the International Boundary Water Commission (IBWC), are planning short- and long-term improvements to the Mexicali wastewater system. These improvements include, among others, rehabilitating and expanding the Mexicali I wastewater treatment plant and constructing a Mexicali II wastewater treatment plant. The purpose of these improvements is to improve sanitation in Mexicali and to improve the quality of water discharged to the New River. After improvements, Mexicali may opt to redirect some or all of the treated wastewater for uses south of the border instead of discharging to the New River, potentially affecting the quantity of inflows to the Salton Sea.

2.7.7 West Mojave Coordinated Management Plan

The West Mojave Coordinated Management Plan is a comprehensive, interagency planning effort for conserving biological resources in the West Mojave region. In 1992, agencies within the West Mojave planning area established a multi-agency partnership to prepare this plan. This partnership includes five military installations in the region, three federal land management agencies, four state agencies, four counties, a water district, and 11 cities and towns.

The goal of the West Mojave planning process is to develop a cost-effective and efficient strategy for the planning area to recover listed species, to minimize the need to list species in the future, and to provide for community growth and resource utilization. The plan will benefit land users, land management agencies, and regulatory agencies by providing a streamlined permit process, by defining consistent mitigation and compensation obligations, and by reducing the need for biological surveys in certain areas, project-specific incidental take permits, and the uncertainty related to requirements for long-term species and habitat conservation. Management alternatives are being developed, and a draft habitat conservation plan (HCP) is scheduled for public distribution in 1999 (BLM 1997).

2.7.8 Coachella Valley Multiple Species Habitat Conservation Plan

This project entails the development of a multiple species HCP with the goals of protecting species of concern while improving the regulatory processes guiding species management. The HCP would enable incidental take permits to be issued for a variety of both listed and unlisted species that occur in the plan area. The planning area covers approximately 1,950 square miles in the Coachella Valley and the surrounding mountains of Riverside County and is being developed by the Coachella Valley Mountains Conservancy. Cooperating agencies also include the National Park Service (NPS), the Natural Resources Conservation Service (NRCS), the USFWS, the US Forest Service (USFS), the Bureau of Land Management (BLM), the CDFG, California Department of Parks and Recreation (CDPR), Riverside County, as well as private landowners and organizations. Scheduled completion of the project is early 2000.

2.7.9 Northern and Eastern Colorado Desert Coordinated Ecosystem Management Plan

The Northern and Eastern Colorado Desert Coordinated Ecosystem Management Plan is a multi-agency management plan for a wide range of habitats and species of concern. The planning area is approximately 5.5 million acres northeast of the Salton Sea. The project has two main goals. The first is to review the current land use plan, given the 1990 listing of the desert tortoise, which mandates new decisions on ground prescription proposals and land use. This includes each of the recovery units in the northern Colorado Desert, the eastern Colorado Desert, and the eastern half of Joshua Tree National Park. The second goal is to expand the planning effort to include other species and habitats of concern. Approximately 30 wildlife species and 50 plant species are included.

BLM is the lead agency for plan development, with cooperation from NPS, the US Marine Corps (USMC), USGS, USFWS, CDFG, Imperial County, and Riverside County. The management plan will become a binding plan for BLM, NPS, and the USMC gunnery range. Data gathering and analyses have been completed, and the plan is being finalized.

2.7.10 Lower Colorado River Desert Region Plan

This project addresses water and air quality issues related to approximately 700,000 acres of irrigated cropland in the Imperial and Coachella valleys of Imperial and Riverside counties. The project goals include the following:

- Reducing salinity levels in the soil and reducing soil compaction and stratification;
- Reducing nitrate and pesticide levels in drain waters entering the Salton Sea;

- Reducing the amount of nitrates leached into the ground water;
- Reducing the amount of pesticides in runoff and drain water;
- Reducing PM_{10} levels during the critical periods; and
- Development and implementation of TMDLs

NRCS is the lead agency for the project, with cooperation from private landholders, Native American groups, IID, and the Bard Resource Conservation District. The project is scheduled to be completed in early 2002.

2.7.11 Colorado River Basin Watershed Management Initiative

This basin-wide management initiative is an internal strategic planning mechanism aimed at identifying and prioritizing water quality issues in the Region. The initiative includes identifying actions that need to be taken to address water quality issues, and estimating the funding required to complete those actions. The Region's Watershed Management Initiative Chapter is updated annually. It is considered to be a 5-year horizon planning document to guide Regional Board efforts, to communicate water quality issues to management, and to provide interested parties with information regarding Regional Board activities.

The Salton Sea Transboundary Watershed was designated as a Category 1 (priority) Watershed under California's 1998 Unified Watershed Assessment (UWA). The California UWA was developed and implemented in response to the Clean Water Action Plan. The UWA was a collaborative process between the State and EPA and was developed to guide allocation of new federal resources for watershed protection.

2.7.12 Coachella Valley/Salton Sea Nonpoint Source Project

The Whitewater River conveys flow from wastewater plant discharge, agricultural drainage, and rainfall to the Salton Sea, which may present serious threats to wildlife and recreation in the area. This project is an integrated program to address the environmental problems of nonpoint source pollution in the Salton Sea and Whitewater River. The lead agency for this action is the Morongo Consortium of Coachella Valley Tribal Bands.

Project objectives are as follows:

- Promote the restoration of impaired beneficial uses of water resources;
- Develop and implement ground water protection measures;
- Develop partnerships with stakeholders in the watershed in a cooperative water quality monitoring effort;
- Construct wetlands test cells for treating agricultural drainage water with aquatic vegetation before it discharges to the Salton Sea;
- Make data generated under this project accessible to the general public;

- Implement Best Management Practices (BMPs) for controlling nonpoint source pollution; and
- Increase public awareness and participation in pollution prevention.

2.7.13 Coachella Valley Water Management Plan

This project plan would guide water management in the Coachella Valley through 2015. Water management strategies that address such issues as groundwater depletion may increase runoff to the Salton Sea by 50,000 to 60,000 af/yr by the end of the planning period. The Plan, and an EIR analyzing the potential environmental effects, are being developed by the Coachella Valley Water District.

2.7.14 Mesquite Regional Landfill

A Class III sanitary landfill is proposed on approximately 4,245 acres of land on and adjacent to the Mesquite Gold Mine and Ore Processing Facility northeast of Glamis in eastern Imperial County. Municipal solid waste from Southern California would be hauled to the proposed landfill by railroad. The estimated daily number of trains that would be required would be one train during Year 1 and up to 5 trains after Year 7. An estimated total of 268 long-term operations-related direct jobs would be created by the proposed project. The proposed landfill would be constructed and operated to meet all federal, state, and county standards regarding design, construction, and operation of a landfill. These include lining requirements, landfill gas and leachate recovery monitoring requirements, and closure requirements.

A draft EIS/EIR has been prepared to address the potential impacts and mitigation measures for constructing and operating the proposed Mesquite Regional Landfill project. The BLM is the lead agency for the purpose of complying with the requirements of NEPA, and Imperial County is the lead agency for the purpose of complying with the requirements of CEQA. Because BLM policy prohibits the establishment of new landfills on BLM-managed public lands, the applicant would have to acquire 1,750 acres of federal land through an exchange of privately owned land for the on-site federal land managed by the BLM. The privately owned land proposed for exchange includes the surface and subsurface rights of approximately 2,240 acres of land in the Santa Rosa Mountains Natural Scenic Area (SRMNSA) and near Chuckwala Bench Area of Critical Environmental Concern (ACEC).

2.7.15 Newmont Gold Company's Expansion of the Mesquite (Gold Field) Gold Mine

The proposed expansion of the Mesquite Gold Mine northeast of Glamis in eastern Imperial County includes expansion of several facilities, including extensions of the Big Chief Open Pit Mine and the Rainbow Open Pit Mine, expansion of Out-of-Pit overburden/interburden stockpile areas, construction of additional heap leach facilities, and construction of ancillary facilities, such as access roads and storm water diversion channels. Stormwater diversion channels will be constructed, and existing drainages within the project site will be modified.

2.7.16 Gateway of the Americas Specific Plan as the New Port of Entry

The Gateway of the Americas Specific Plan Area ("Gateway") is a master-planned industrial and commercial complex consisting of approximately 1,775 acres owned by private parties, as well as federal, state, and local agencies. The planning area is adjacent to the International Boundary, approximately six miles east of Calexico, and surrounds the new 87-acre International Port of Entry (POE) on the US side of the border. The Gateway would provide a broad array of industrial, commercial, and transportation-related services, as well as retail shopping, business offices, and lodging that would be required throughout the area as a result of the traffic that will be generated by the POE. The area is bounded on the west by the Ash Canal, on the north by a line parallel to the centerline of State Route 98, on the east by the Alamo River, and on the south by the northern right-of-way of the All American Canal. A specific plan has been completed for the project.

2.7.17 Heber Wastewater Treatment System Project

The Heber Wastewater Treatment Project involves expanding and upgrading the current wastewater facility in Heber, located approximately five miles north of the US/Mexican border in Imperial County. Discharge from the facility is into an agricultural drain that eventually flows into the Alamo River and ultimately the Salton Sea. Modifications would permit treating additional capacity and adding a disinfection facility.

2.7.18 Drain Water Quality Improvement Plan—Imperial Irrigation District

The project objectives are to protect the beneficial uses of waterbodies receiving agricultural drainage flows and to improve the water quality of the New River, the Alamo River, and the Salton Sea by establishing baseline water quality goals in the IID service area, by pinpointing pollution sources, and by implementing BMPs. The plan is being implemented by IID, with assistance from NRCS, USBR, USGS, and the Imperial Resource Conservation District.

2.7.19 Dos Palmas Habitat Restoration/Enhancement

This project is managing approximately 20,000 acres of nature preserve near the town of North Shore, on the northeast shore of the Salton Sea. The purposes of the project are as follows:

- Provide refuge for endangered species;
- Provide public recreation and educational opportunities; and
- Manage the watershed on an ecosystem basis to provide for natural functioning of processes.

An interdisciplinary team has developed a restoration plan, and components of the plan, including modifying 25 acres of wetland to create habitat for endangered species and a tamarisk removal program, have been implemented. BLM is the lead agency for this action.

2.7.20 Caltrans: Route 86 Expressway Mitigation

Caltrans is performing three types of mitigation along Route 86 in Riverside County. These include the following:

- Restoring 112 acres of alkali sink scrub habitat;
- Reconstructing 18.5 acres of wetlands; and
- Creating 20 acres of Desert pupfish habitat.

The last two mitigation measures have been completed, while the first is scheduled to be completed within the next two to three years.

2.7.21 Coachella Valley National Wildlife Refuge—Salt Cedar Removal

This project involves eradicating salt cedar (tamarisk) to restore 3,000 acres of habitat for the federally listed threatened Coachella Valley fringe-toed lizard. The project lead is the Coachella Valley Mountains Conservancy.

2.7.22 Lewis Drain Treatment Facility

The project involves constructing treatment facilities for agricultural drainage to reduce the selenium concentration in subsurface drainage water (tile water) and to explore reuse possibilities for agricultural surface water runoff. Tile runoff is diverted to a subsurface treatment pond where anaerobic activity would deplete the selenium concentration. Surface water runoff would be collected in a shallow pond to facilitate nutrient and pesticide removal. The project, undertaken by IID and USBR, is scheduled for completion in mid-2001.

2.7.23 Peach/Pampas Watershed Study

The Peach/Pampas Watershed Study was instituted to quantify the improvement of water quality in agricultural drains within a 3,000-acre watershed in Imperial County, following implementation of BMPs to reduce sediment load. Preproject data of sediment transport off individual fields and at a drain discharge point was collected. Sediment reduction BMPs will be implemented and post-project data will be compiled to estimate a reduction in sediment load. IID is the lead agency for this project, with cooperation from NRCS and private landholders. The project is scheduled for completion in the near term.

2.7.24 Duck Club Evaporative Ponds

This project diverts water from several drainage systems into ten evaporation ponds in order to deplete nutrients, pesticides, and selenium. The ponds are sampled at the inlet and outlet to determine the water quality impacts of the ponds and appropriate management techniques. Selenium levels in the water have decreased. IID is the lead agency for this project, with cooperation from Reclamation and private landholders. This action began in 1995 and is ongoing.

2.7.25 Brawley, California Wetlands Project

The long-term goal of this project is to find a cost-effective and reliable water quality treatment that will have local and statewide impact on agricultural drain pollution. The short-term goal is to improve impaired agriculture drain water quality so it can meet and support water quality objectives and designated beneficial uses. IID is the lead agency for this 3-yr study, which is supported by a single congressional appropriation with no secure long-term funding. The project is to be completed in late 2002.

Low-cost wetland technology will be tested as to its efficacy in treating agricultural drainage water and water in the New River. The wetlands are being designed to provide sediment removal and detention time for the treatment of nutrients and selenium. The level of removal is yet to be determined; however, it is believed that some level of treatment will occur. Two project sites are being considered—a 68-acre site in Imperial to treat drain water from the Rice 3 drain flowing into the New River and a seven-acre site in Brawley to treat New River water. The Brawley site will include diversion to a 7-acre wetland facility that will provide sediment removal and detention time for nutrients and selenium depletion. The data generated will assist in determining the total maximum daily load (TMDL) for silt development by providing a pilot study of silt reduction. Data also will be collected for TMDLs for selenium, pesticides, and nutrients.

2.7.26 Whitewater River Flood Control Project

The US Army Corps of Engineers, in partnership with the Coachella Valley Water District, is evaluating alternative measures for accomplishing flood protection within the Whitewater River basin. The project has the dual objectives of flood control and environmental preservation. A reconnaissance study was conducted in 1992, and a feasibility study is being prepared.

2.7.27 Colorado River Basin Salinity Control Program

This action, pursuant to the 1974 Colorado River Basin Salinity Control Act, Public Law 93-320, as amended, provides for the construction, operation, and maintenance of projects in the Colorado River Basin to control the salinity of water delivered to Mexico. A wide range of salinity control actions have been undertaken in the Colorado River basin as part of this program. These actions include construction of a desalting plant at Yuma, Arizona, lining of the Coachella Canal, development of a protective well field along the US/Mexico border, a replacement flow study, a salinity control program on BLM land, a voluntary on-farm salinity control program by USDA, and a program for funding basin-wide salinity control projects through competitive bid. This action is implemented by a variety of stakeholders and actions are coordinated by an interagency group, the Colorado River Basin Salinity Control Forum.

2.8 REGULATORY FRAMEWORK AND MITIGATION MONITORING

The Salton Sea Restoration Project will operate within the framework of a number of regulations designed to protect the environment. The regulatory requirements include water quality standards, water rights issues, biological resource protection, air quality standards, cultural resource protection, Indian Trust Assets, and public trust. A variety of permits will be required to conform to these regulatory requirements. In addition, a monitoring and reporting plan will be implemented to ensure that restoration actions conform to the regulatory requirements and perform as expected and that mitigation measured are applied appropriately. The most important of the regulatory requirements are summarized in Chapter 9, which also includes overviews of the permitting requirements and the mitigation monitoring and reporting plan.

2.9 SUMMARY COMPARISON OF THE ENVIRONMENTAL CONSEQUENCES

2.9.1 Phase 1 Alternatives

A summary of the environmental consequences of Phase 1 actions is provided in Table 2.9-1. All action alternatives would provide long-term beneficial effects to the aquatic and the avian habitat at the Sea. Other benefits could include socioeconomic recovery of the area. Some potentially significant adverse impacts have also been identified. Probably the greatest of these effects would be the visual impacts and loss of desert habitat associated with the ESS facilities that are part of alternatives 2, 3 and 4. In addition, for the evaporation ponds that are part of alternatives 1 and 4, concerns include release of brine material in the event of a dike failure, possible effects on birds that try to feed on fish in the highly saline ponds, Native American resource impacts, and the ultimate fate of salts that accumulate in the ponds.

2.9.2 Phase 2 Actions

Summaries of the environmental consequences of Phase 2 export actions are provided in Table 6-2. With the implementation of Phase 2 actions, program goals could be achieved except for the case where inflows are reduced to 0.8 maf/yr. In this case, it would be possible to achieve target salinity, but not target water surface elevation. Further discussion of the performance of Phase 2 alternatives is provided in Chapter 6. In general, the greatest potential for environmental impacts associated with Phase 2 actions would be in the receiving areas of the export alternatives.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Surface Water Resources					
Surface Water Elevation	Current Inflow: Elevation would increase to –224 ft msl by 2030. Reduced Inflow: Elevation would decrease below target with reduced inflows to –234 ft msl by 2030.	Current Inflow: After an initial increase to –223 ft, elevation would decrease to –229 ft msl by 2030. Reduced Inflow: Elevation would decrease below target with reduced inflows to –237 ft msl by 2030.	Current Inflow: After initial rise to –226 ft, elevation would decrease to target level of –232 ft msl by 2030. Reduced Inflow: Elevation would decrease below target with reduced inflows to–237 ft msl by 2030.	Current Inflow: After initial rise to –225 ft, elevation would decrease to –229 ft msl by 2030. Reduced Inflow: Elevation would decrease below target with reduced inflows to –235 ft msl by 2030.	Current Inflow: After initial rise to –226 ft, elevation would decrease to target level of –232 ft msl by 2030. Reduced Inflow: Elevation would decrease below target with reduced inflows to –236 ft msl by 2030.
Surface Water Quality	Current Inflow: Salinity would increase to 53,000 mg/L by 2030. Reduced Inflow: Salinity would increase to 75,000 mg/L by 2030.	Current Inflow: Salinity would decrease to 37,000 mg/L by 2030. Reduced Inflow: Salinity would increase to 46,000 mg/L by 2030. Increased size of fresh water mixing zone at tributary outlets. Temporary water quality degradation during dike construction from dredge sediment. Potential significant water quality impacts from evaporation pond if dike failure occurs.	Current Inflow: Salinity initially would increase to 47,000 mg/L then would decrease to 45,500 mg/L by 2030. Reduced Inflow: Salinity would increase to 54,000 mg/L by 2030. Potential salinity increase from salt transport to San Felipe Creek (windblown or seepage).	Current Inflow: Salinity initially would increase to 45,000 mg/L, then would decrease to 40,000 mg/L by 2030. Reduced Inflow: Salinity would increase to 47,000 mg/L by 2030. Increased size of fresh water mixing zone at tributary outlets. Temporary water quality degradation during dike construction from dredge sediment. Potential significant water quality impacts from evaporation pond if dike failure occurs.	Current Inflow: Salinity initially would increase to 45,000 mg/L, then would decrease to 41,000 mg/L by 2030. Reduced Inflow: Salinity initially would increase to 49,000 mg/L, then would decrease to 46,000 mg/L by 2030. Increased size of fresh water mixing zone at tributary outlets. Temporary water quality degradation during dike construction from dredge sediment. Potential significant water quality impacts from evaporation pond if dike failure occurs.
Sea Circulation	Current and Reduced Inflows: Negligible change in circulation pattern due to minor increase in elevation for current conditions, and minor increase in current velocities due to shallower water for reduced inflow conditions.	Current and Reduced Inflows: Interference by pond dikes may change circulation pattern in south basin leading to local sediment deposition and scouring areas. Slightly increased velocity due to shallower Sea for reduced inflow.	Current and Reduced Inflows: Minor increase in current velocity due to decreased elevation, similar to effects under No Action with reduced inflows.	Current and Reduced Inflows: Potential local changes in circulation due to interference from pond dikes, similar to Alternative 1.	Current and Reduced Inflows: Potential local changes in circulation due to interference from pond dikes, similar to Alternative 1.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Ground Water Resources					
Ground Water Hydrology	Current and Reduced Inflows: No effects on ground water.	Current and Reduced Inflows: Ground water effects depend on Sea elevation. Rising Sea elevation would increase base level of regional aquifer. May increase drainage problems in Coachella Valley. Lowering of Sea level would have opposite effect. No effect on perched water table, such as in Imperial Valley, because water table is recharged by irrigation and artificially drained. May reduce existing adverse effects of high water table in Coachella Valley.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation.
Ground Water Quality	Current and Reduced Inflows: No impacts on groundwater quality	Current and Reduced Inflows: Lowering regional water table may cause temporary improvement in ground water quality by increasing flow rate and reducing residence time of salts and contaminants. Increased base level and increased salinity may increase potential for saline water intrusion close to Sea. Change in elevation of Sea would not affect perched water table in Imperial County.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation.	Current and Reduced Inflows: Same as for Alternative 1. Impacts would be related to Sea elevation
Geology and Soils					
Soils and Sediments	Current Inflows: No effect. Reduced Inflows: Bottom sediments, that could contain elevated levels of some chemical constituents of concern such as heavy metals would be exposed around the perimeter of the Sea.	Current and Reduced Inflows: Bottom sediments, that could contain elevated levels of some chemical constituents of concern such as heavy metals could be exposed around the perimeter of the Sea. There would be some reworking of soils and sediments at facility sites. Standard construction practices would be used to minimize erosion.	Current and Reduced Inflows: Soil and sediment impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Soil and sediment impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Soil and sediment impacts would be the same as described for Alternative 1.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Geologic Hazards	Current and Reduced Inflows: No impacts are expected.	Current and Reduced Inflows: Facilities could be damaged by earthquakes, but repairs would be made under long-term operation and maintenance program for the project. However, if damages caused a substantial increase in Sea salinity prior to repair, the effects on the Sea environment would be unavoidable.	Current and Reduced Inflows: Geologic hazard impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Geologic hazard impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Geologic hazard impacts would be the same as described for Alternative 1.
Air Quality					
Air Quality Conditions	Current Inflows: No direct or indirect impacts on air quality conditions. Reduced Inflows: areas exposed by receding water levels would generally be expected to revegetate slowly in a manner consistent with adjacent shoreline areas, resulting in minimal potential for increased wind erosion problems. The decline in water levels would not be expected to produce significant new salt deposits around the shoreline.	Current and Reduced Inflows: Construction of ponds would result in significant fugitive dust and vehicle emissions during the construction period. Because there would be limited public access to the construction site or haul road vicinity, public exposure to high PM_{10} concentrations would be limited. The construction work force would be the major affected population.	Current and Reduced Inflows: Construction of the EES would result in fugitive dust and vehicle emissions during the construction period. Operation of the EES could result in significant salt drift downwind of the EES system during periods of strong winds.	Current and Reduced Inflows: Construction of ponds would result in significant fugitive dust and vehicle emissions during the construction period. Because there would be limited public access to the construction site or haul road vicinity, public exposure to high PM_{10} concentrations would be limited. The construction work force would be the major affected population. Operation of the EES could result in significant salt drift downwind of the EES system during periods of strong winds.	Current and Reduced Inflows: Construction of ponds would result in significant fugitive dust and vehicle emissions during the construction period. Because there would be limited public access to the construction site or haul road vicinity, public exposure to high PM_{10} concentrations would be limited. The construction work force would be the major affected population. Alternative 5 would have a lower potential for off-site salt drift impacts than the other EES system alternatives.
Air Quality Planning	Current and Reduced Inflows: No direct or indirect impacts on air quality conditions.	Current and Reduced Inflows: Emissions from on-site construction activities could require a Clean Air Act conformity review. Options for achieving compliance with the Clean Air Act conformity rule are limited. If diesel-fueled pumps are used for the evaporation ponds, they would require permits from the Imperial County Air Pollution Control District.	Current and Reduced Inflows: Emissions from on-site construction activities could require a Clean Air Act conformity review. Constructing and operating the EES system would require air quality permits. Permit conditions may include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.	Current and Reduced Inflows: Emissions from on-site construction activities could require a Clean Air Act conformity review. If diesel-fueled pumps are used for the evaporation ponds, they would require permits from the Imperial County Air Pollution Control District. Constructing and operating the EES system also would require air quality permits with possible permit conditions.	Current and Reduced Inflows: Emissions from on-site construction activities could require a Clean Air Act conformity review. If diesel-fueled pumps are used for the evaporation ponds, they would require permits from the Imperial County Air Pollution Control District. Constructing and operating the EES system also would require air quality permits with possible permit conditions.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Noise					
Noise Effects	Current and Reduced Inflows: No direct noise effects since no new noise sources would be introduced, and no increases in noise levels would occur. Potential minor indirect decrease in noise levels if the condition of the sea continued to degrade and vehicle traffic to the Sea and watercraft use on the Sea decreased.	Current and Reduced Inflows: Minor short-term local construction noise from use of heavy construction equipment, truck traffic, and dredging. Minor operational-related noise effects from additional dredging and truck hauling, cleanup and fish harvesting operations.	Current and Reduced Inflows: Minor short-term local construction noise, but less than that described for Alternative 1 because less earthmoving would be required. Minor operational-related noise effects from pump operations and heavy truck hauling, cleanup and fish harvesting operations.	Current and Reduced Inflows: Minor short-term local construction noise, greater than that described for Alternative 1 because a larger area would be disturbed. Minor operational-related noise effects from additional dredging and heavy truck hauling, cleanup and fish harvesting operations.	Current and Reduced Inflows: Minor short-term local construction noise similar to Alternative 1. Potential significant but mitigable impacts from ground-based EES system. Minor operational-related noise effects from additional dredging and heavy truck hauling, cleanup and fish harvesting operations.
Fisheries and Aquatic Ecosystems					
Lower Trophic Levels	Current Inflow: Significant impacts due to salinity increases. Potential loss of rotifer, copepod and barnacle populations, significantly changing the invertebrate population dynamics. Reduced Inflow: In addition to impacts described above, would likely cause an initial increase in polychaete density followed by a rapid decline as salinities continue to rise.	Current Inflow: Significant and mitigable short-term impacts during construction from effect of increased turbidity, accelerated local eutrophication, oxygen depletion, food chain impacts, and introduction of trace elements. Minor adverse impact from decrease in available habitat as a result of the evaporation ponds. Overall beneficial impacts, as the evaporation ponds would stabilize salinity levels and control the elevation of the Sea. Long-term beneficial effect on barnacles as the creation of dikes would provide new substrate for habitat. Reduced Inflow: Same as described above with additional habitat loss due to reduced Sea elevation.	Current Inflow: Minor short-term impacts during construction. Long term beneficial impacts due to control of salinity levels and Sea elevation stabilization. Reduced Inflow: Minor short term impacts during construction. Salinity levels will take longer to stabilize (compared with current inflow) and may result in a loss of rotifer, copepod, and barnacles during Phase 1.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Reduced Inflow: Same as described above with additional habitat loss due to reduced Sea elevation.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Reduced Inflow: Same as described above with additional habitat loss due to reduced Sea elevation.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Fish	Current Inflow: Significant negative impacts due to the salinity increase. Loss of sport fish species; corvina, sargo, and possibly croaker. In addition there will be a significant change in the invertebrate populations which make up the food base. Reduced Inflow: In addition to the impacts described above, increased salinities may result in the loss of tilapia and possibly desert pupfish populations.	Current Inflow: Significant and mitigable short-term impacts during construction from disturbance of seasonal patterns (i.e. spawning) if construction activities interfere with breeding of fish species. Minor impact from decrease in available habitat as a result of the evaporation ponds. Overall long-term beneficial impacts, as the evaporation ponds would stabilize salinity levels and control the elevation of the sea. Reduced Inflow: Same as described above with additional habitat loss due to reduced Sea elevation.	Current Inflow: Minor short-term impact during construction. Long-term beneficial impacts due to control of salinity levels and Sea level stabilization. Reduced Inflow: Minor short-term impacts during construction. Salinity will take longer to control and may result in loss of corvina, sargo and croaker during Phase 1. Additionally, imported flood flows may negatively impact fish populations in the Alamo River due to flushing flows.	Current Inflow: Impacts would be the same as described for Alternatives 1 and 2. Reduced Inflow: Same as described above with increased habitat loss due to reduced Sea level elevation. Additionally, imported flood flows may negatively impact fish populations in the Alamo River due to flushing flows.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Reduced Inflow: Same as described for Alternative 4.
Special Status Species	Current Inflow: No significant impact to desert pupfish. Reduced Inflow: Significant negative impacts to desert pupfish populations as salinity levels increase.	Current Inflow: Significant adverse short-term impacts as construction of evaporation ponds would involve activities in shallow water corridors used for pupfish movement between drainages. These activities will be mitigated by the construction of the pupfish pond. Long-term beneficial impacts due to salinity and elevation control. Reduced Inflow: Same as described above with additional loss of shallow water corridors due to reduced elevation of the Sea.	Current Inflow: Minor short-term impact during construction. Long-term beneficial impacts due to control of salinity levels and Sea level stabilization. Reduced Inflow: Similar impacts as described above. Additionally, imported flood flows may negatively impact pupfish populations due to flushing and temporary predation.	Current Inflow: Same as those described for Alternatives 1 and 2. Reduced Inflow: Same as those described for Alternative 2.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Additionally, there would be beneficial impacts from the creation of the North wetland habitat and pupfish pond, which serve to protect shallow water habitats. Reduced Inflow: Same as those described for Alternative 2.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Sport Fisheries	Current Inflows: Significant negative impacts, including loss of corvina, sargo and possibly croaker. Reduced Inflows: In addition to the impacts described above, increased salinities may result in the loss of the tilapia population thereby eliminating the sport fishery.	Current Inflow: Long-term beneficial impact to fish due to improvements in salinity levels. Reduced Inflow: Same beneficial impacts as described above. Some adverse impacts resulting from the loss of habitat due to reduced Sea elevation.	Current Inflow: Minor short-term impact during construction. Long-term beneficial impacts due to the control of salinity level and Sea level stabilization. Reduced Inflow: Control of salinity will take longer than described under current inflow conditions. Consequently, corvina, sargo and croaker may be lost during phase 1 due to increased salinity levels.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Reduced Inflow: Same impacts as described for Alternative 1.	Current Inflow: Same impacts as described for Alternatives 1 and 2. Reduced Inflow: Same impacts as described for Alternative 1.
Avian Resources					
Bird Species	Current Inflow: Significant and unmitigable avian resource impacts would occur due to increased salinity. Reduced Inflow: Significant and unmitigable avian resource impacts would occur due to increased salinity. In addition the Sea level would be lowered causing a loss of nearshore habitat and exposing Mullet Island to predation.	Current Inflow: Significant and mitigable impacts during construction from direct loss of avian habitat. Significant beneficial impacts to aquatic avian species with reduced salinity levels in the Sea. Addition impacts would occur if species try to feed on fish in the highly saline evaporation ponds. and losses to nearshore habitat from lowered lake level. Potential beneficial effects if reduced salinity would prevent loss of prey base for these species. Reduced Inflow: Impacts similar to current inflows except losses to nearshore habitat would be less.	Current Inflow: Significant and unmitigable impacts to upland avian species from loss of 7,500 acres of desert habitat used for foraging and nesting, exposure to highly toxic waters, collision with spray towers, and salt encrustation. Small loss of nearshore habitat due to lowered Sea elevation Long-term beneficial effects for avian species dependent on the Salton Sea aquatic ecosystem by improving salinity levels and water quality. Reduced Inflow: Similar to above but with little loss of nearshore habitat and greater beneficial impacts due to reduced salinity.	Current and Reduced Inflows: Impacts would the similar as those described for both alternatives 1 and 2.	Current Inflow: Significant unmitigable impacts to upland avian species from a loss of 600 acres of nearshore habitat and loss of habitat due to construction activities. Addition impacts would occur if species try to feed on fish in the highly saline evaporation ponds. Significant beneficial impacts would result from reduced salinity. Reduced Inflow: Similar to above for Current Inflows.
Special Status Species	Current and Reduced Inflows: Impacts would the same as those described above for bird species	Current and Reduced Inflows: Impacts would the same as those described above for bird species.	Current and Reduced Inflows: Impacts would the same as those described above for bird species.	Current and Reduced Inflows: Impacts would the same as those described above for bird species.	Current and Reduced Inflows: Impacts would the same as those described above for bird species.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Vegetation and Wildlife					
Plant Commun-ities	Current Inflow: Loss of approximately 348 acres of wetlands from increased salinity. Reduced Inflow: Losses of wetlands would be increased by increased salinities and lower Sea level.	Current Inflow: Minor adverse impact to wetlands due to construction, operations and possible circulation changes. Reduced Inflows: Similar to above for current inflows.	Current Inflow: Loss of 7,500 acres of desert habitat and associated vegetation would result in significant and unmitigable impacts on vegetation and wildlife. Impacts would result from direct loss of plants, local wildlife species that depend on habitat for food, cover, and reproduction, and resultant loss of prey base for predator species. Long -term benefits of improved salinity levels and water quality to wetland vegetation. Reduced Inflow: Similar to above for current inflow.	Current and Reduced Inflows: Impacts would be similar to those described for Alternatives 1 and 2.	Current Inflow: Significant and unmitigable impacts to nearshore habitat by the lower Sea level. Mitigable impacts to upland habitat would result from construction activities and the construction of the haul road. Beneficial impacts to wildlife species dependent on the Sea would result from lower salinity levels. Reduced Inflow: Similar to above for current conditions but with little loss of nearshore habitat.
Special Status Species	Current Inflow: Potential impacts to California black rail due to loss of habitat. Reduced Inflow: Increased loss of California Black rail habitat.	Current and Reduced Inflows: No impact to special status species.	Current and Reduced Inflows: Loss of 7,500 acres of desert habitat and associated vegetation would result in significant and unmitigable impacts on vegetation and wildlife.	Current and Reduced Inflows: Impacts would be similar to those described for Alternative 1 and 2.	Current and Reduced Inflows: No impacts to special status species.
Sensitive Habitats	Current Inflow: Loss of Wetlands due to increased salinity. Reduced Inflow: Greater loss of wetlands due to higher salinity levels and lower lake levels over current inflow conditions.	Current and Reduced Inflows: Minor adverse impacts to wetlands due to construction, operations and possible circulation changes..	Current and Reduced Inflows: Similar to Alternative 1.	Current and Reduced Inflows: : Similar to Alternative 1.	Current and Reduced Inflows: : Similar to Alternative 1.
Sensitive Plants	Current and Reduced Inflows: No impact to sensitive plants.	Current and Reduced Inflows: No impact on sensitive plants.	Current and Reduced Inflows: Loss of 7,500 acres of desert habitat and associated vegetation could have a significant and unmitigable impact on sensitive plants.	Current and Reduced Inflows: Impacts would be similar to those described for Alternative 2.	Current and Reduced Inflows: Impacts would be similar to those described for Alternative 2.
Socioeconomics					
Regional Econ.	Current and Reduced Inflows: Deterioration in water quality and the eventual loss of wildlife would cause adverse effects from a decline in recreational use and related commercial activities, reduced employment, and reduced property values.	Current and Reduced Inflows: Employment during the construction phase would generate negligible to slightly beneficial effects on employment and wages. Increased recreational use of the Sea would spur associated commercial and residential development.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.
Public Finance	Current and Reduced Inflows: No impact on public finances	Current and Reduced Inflows: Any increased need for public services	Current and Reduced Inflows: Effects would be similar to those	Current and Reduced Inflows: Effects would be similar to those	Current and Reduced Inflows: Effects would be similar to those

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
	would be expected.	would be offset by increases in local tax revenues from project-related spending.	described under Alternative 1.	described under Alternative 1.	described under Alternative 1.
Demo-graphics and Housing	Current and Reduced Inflows: No impact on demographics or housing would be expected.	Current and Reduced Inflows: Construction would have a negligible effect on area population and housing as much of the construction workforce is expected to come from outside the area and require temporary housing.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.	Current and Reduced Inflows: Effects would be similar to those described under Alternative 1.
Land Use and Planning					
Local Land Use Plans and Policies	Current Inflow: No conflict with local land use plans and policies. No impact to urban land uses. Reduced Inflow: Significant and unmitigable impact would occur as a result of decreased Sea level and consequent changes in land use patterns.	Current inflows: No significant conflict with local land use plans and policies. Urban land use patterns and economic viability could improve if restoration activities are successful, a beneficial effect.. Construction activities would not be compatible with prescribed military use at the Salton Sea Test Base, but would not be a significant effect.. Commercial and industrial land use patterns and economic viability could improve if restoration activities are successful, a beneficial effect. Reduced Inflow: Effects would be similar to those described under the No Action Alternative.	Current inflows: The EES would be inconsistent with permitted uses in the area, and given the scale and industrial nature of this facility, would result in a significant and unmitigable impact. Effects on urban land uses would be similar to those described under Alternative 1. Reduced Inflow: Additional significant and unmitigable impact similar to that described under the No Action Alternative.	Current inflow: The EES would be inconsistent with permitted uses in the area, and given the scale and industrial nature of this facility, would result in a significant and unmitigable impact. Reduced Inflow: Additional significant and unmitigable impact similar to that described under the No Action Alternative.	Current inflow: The EES would be inconsistent with permitted uses in the area, and given the scale and industrial nature of this facility, would result in a significant and unmitigable impact. Reduced Inflow: Additional significant and unmitigable impact similar to that described under the No Action Alternative.
Agricultural Land Resources					
Ag. Land Use	Current and Reduced Inflows: No effects on agricultural land use.	Current and Reduced Inflows: No effects on agricultural land use.	Current and Reduced Inflows: Less than significant impacts to agricultural land use.	Current and Reduced Inflows: Less than significant impacts to agricultural land use.	Current and Reduced Inflows: Less than significant impacts to agricultural land use.
Ag. Econ.	Current and Reduced Inflows: No effects on agricultural economics.	Current and Reduced Inflows: No effects on agricultural economics.	Current and Reduced Inflows: No effects on agricultural economics.	Current and Reduced Inflows: No effects on agricultural economics.	Current and Reduced Inflows: No effects on agricultural economics.
Recreational Resources					
Local and Regional Rec-reation	Current and Reduced Inflows: Increased salinity levels and unstable elevation would have a significant adverse impact on recreational resources.	Current and Reduced Inflows: Less than significant effect from loss of Sea used for boating and other water-based uses and loss of wildlife viewing opportunities. Short-term less than significant construction effects on recreation uses. Possible indirect negative impact to recreation	Current and Reduced Inflows: Moderately significant impacts to land-based recreation access and facilities and water-based recreational facilities and operations. Possible indirect negative impact to recreation experience resulting from aesthetic degradation. Potential	Current and Reduced Inflows: Possible indirect negative impact to recreation experience resulting from aesthetic degradation along State Route 86. Short-term less than significant construction effects on land-based recreation uses. Potential long-term beneficial effects for	Current and Reduced Inflows: Impacts would be the same as those described for both Alternatives 1 and 3.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
		experience resulting from aesthetic degradation along shoreline. Potential long-term beneficial effects for boating and water access facilities and overall recreation interests.	long-term beneficial effects for boating and water access facilities and overall recreation interests.	boating and water access facilities and overall recreation interests.	
Visual Resources and Odors					
Visual Resources	Current Inflow: No significant visual impacts. Reduced Inflow: Significant visual impacts would be expected, having a moderate to strong visual contrast with the surrounding landscape.	Current Inflow: Significant and unmitigable visual impacts during construction to viewers in Salton City and Desert Shores, as well as motorists driving SR 86. Both significant and less then significant visual impacts during facility operations to viewers in Salton City, Desert Shores, and driving SR 86. Reduced Inflow: Less then significant visual impacts are expected during construction to viewers in Red Hill Marina, SR 111, and Torres Martinez Reservation. Significant visual impacts to viewers in Red Hill Marina. Less then significant visual impacts will occur for motorists on SR 111 and residents of the Torres Martinez Reservation.	Current Inflow: Less than significant visual impacts during construction. Significant visual impacts during facility operations to residents in Lark Spa, Fountain of Youth, visitors to the Dos Palmas Reserve, and motorists driving along SR 111 and SR 86. Reduced Inflow: Impacts related to construction activities are similar to those discussed under Alt. 1 reduced inflow conditions. Views of the EES facility would not be substantially different from the Current Inflow scenario.	Current Inflow: Both construction and facility impacts would be similar to those discussed in Alternatives 1 and 3. Reduced Inflow: Impacts would be similar to those discussed in Alternative 1 and 2 reduced inflow conditions.	Current Inflow: Both construction and facility impacts would be similar to those discussed in Alternatives 1 and 3. Reduced Inflow: Impacts for both construction and facility operations would be similar to Alternative 1 reduced inflow.
Odors	Current and Reduced Inflows: May result in an increase in noxious odors if current flows cause an increase in conditions that produce odors.	Current Inflow: Temporary odors expected while dredging sludge materials. More permanent odors could result if ponds generate algal blooms, but would be partially offset by fewer algal blooms, fish kills, and avian kills in the Sea. Operation of a fish processing plant could result in significant odor problems but could be mitigated with control technology. Reduced Inflow: Potential increase in noxious odors if reduced flows in the Sea cause conditions that produce an increase in odors.	Current Inflow: Beneficial effect if reduced salinity levels result in fewer algal blooms, fish kills, and avian kills. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1. Operation of a fish processing plant could result in significant odor problems but could be mitigated with control technology. Reduced Inflow: Potential increase in noxious odors if reduced flows in the Sea cause conditions that produce an increase in odors.	Current Inflow: Temporary odors expected while dredging sludge materials. More permanent odors could result if ponds generate algal blooms, but would be partially offset by fewer algal blooms, fish kills, and avian kills in the Sea. Operation of a fish processing plant could result in significant odor problems but could be mitigated with control technology. Reduced Inflow: Potential increase in noxious odors if reduced flows in the Sea cause conditions that produce an increase in odors.	Current Inflow: Temporary odors expected while dredging sludge materials. More permanent odors could result if ponds generate algal blooms, but would be partially offset by fewer algal blooms, fish kills, and avian kills in the Sea. Operation of a fish processing plant could result in significant odor problems but could be mitigated with control technology. Reduced Inflow: Potential increase in noxious odors if reduced flows in the Sea cause conditions that produce an increase in odors.

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
Public Health and Environmental Hazards					
Unexploded Ordnance	Current and Reduced Inflows: No effect on unexploded ordnance.	Current and Reduced Inflows: A potentially significant mitigable impact could result from disturbing unexploded ordnance during construction activities at the Salton Sea Test Base, which could endanger the safety of construction workers.	Current and Reduced Inflows: Alternative 2: no effect on unexploded ordnance. Alternative 3: same as described for Alternative 1.	Current and Reduced Inflows: Same as described for Alternative 1.	Current and Reduced Inflows: Same as described for Alternative 1.
Biological Pathogens	Current Inflow: no effect on biological pathogens. Reduced inflow: possible increase in biological pathogen levels.	Current and Reduced Inflows: possible increase in biological pathogen levels.	Current and Reduced Inflows: Same as described for Alternative 1.	Current and Reduced Inflows: Same as described for Alternative 1.	Current and Reduced Inflows: Same as described for Alternative 1.
Insect-borne Diseases	Current Inflow: slight increase in the potential for transmission of mosquito-borne diseases Reduced inflow: reduced potential for transmission of mosquito-borne diseases.	Current and Reduced Inflows: temporary increase in potential for transmission of mosquito-borne diseases followed by a sustained decrease.	Current and Reduced Inflows: reduced potential for transmission of mosquito-borne diseases.	Current and Reduced Inflows: Same as described for Alternatives 2 and 3.	Current and Reduced Inflows: Same as described for Alternatives 2 and 3.
Chemical Hazards	Current Inflow: no effect on chemical hazards. Reduced Iinflow: potential increase in the selenium health hazard for fish consumers. Potential exposure of contaminated sediments resulting from the decline in Sea level.	Current and Reduced Inflows: Construction activities could temporarily increase the concentration of selenium in the Sea, but the effect would not be significant. Less-than-significant effects from petroleum product spills. Potential increase in selenium health hazard for fish consumers. Potential exposure of contaminated sediments resulting from the decline in Sea level. Increased use of motorized watercraft would increase releases of petroleum fuels and oils.	Current and Reduced Inflows: Same as those described for Alternative 1.	Current and Reduced Inflows: Same as those described for Alternative 1.	Current and Reduced Inflows: Same as those described for Alternative 1.
Utilities and Public Services					
Utilities	Current and Reduced Inflows: No impacts are expected.	Current and Reduced Inflows: Some increased demand for local utilities; not expected to result in a significant adverse effect on local utility suppliers.	Current and Reduced Inflows: Some increased demand for local utilities; not expected to result in a significant adverse effect on local utility suppliers. For Alternative 2, high-power lines and towers would need to be relocated, a significant and mitigable impact.	Current and Reduced Inflows: Some increased demand for local utilities; not expected to result in a significant adverse effect on local utility suppliers.	Current and Reduced Inflows: Some increased demand for local utilities; not expected to result in a significant adverse effect on local utility suppliers
Public Services	Current and Reduced Inflows: No impacts	Current and Reduced Inflows: Increased delays	Current and Reduced Inflows: Temporary	Current and Reduced Inflows: Increased delays	Current and Reduced Inflows: Increased delays

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
	are expected.	on State Route 86 during construction would be a significant and potentially not mitigable impact. No significant effect on education, police service, or fire service.	delays on State Route 86 (and State Route 111 for Alternative 2) during beginning and ending of construction would be a less than significant. No significant effect on education, police service, or fire service.	on State Route 86 during construction would be a significant and potentially not mitigable impact. No significant effect on education, police service, or fire service.	on State Route 86 during construction would be a significant and potentially not mitigable impact. No significant effect on education, police service, or fire service.
Cultural and Ethnographic Resources					
Cultural and Ethno-graphic Resources	Current and Reduced Inflows: Both adverse and beneficial impacts could occur if sites considered sensitive by the Torres Martinez in the Sea are exposed; exposed resources may be subject to vandalism or looting, but also could be preserved.	Current and Reduced Inflows: Significant and mitigable impacts could occur from construction activities, dredging, and exposure of sites. Significant and not mitigable impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez.	Current and Reduced Inflows: Significant and mitigable impacts could occur from construction activities, dredging, and exposure of sites. Significant and not mitigable impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez. Potential mitigable impacts to archaeological sites within the Test Base site (Alternative 3).	Current and Reduced Inflows: Significant and mitigable impacts could occur from construction activities, dredging, and exposure of sites. Significant and not mitigable impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez. Potential mitigable impacts to archaeological sites within the Test Base site.	Current and Reduced Inflows: Significant and mitigable impacts could occur from construction activities, dredging, and exposure of sites. Significant and not mitigable impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez.
Indian Trust Assets					
Indian Trust Assets	Current and Reduced Inflows: Impacts may result from the inundation of Tribal lands from rising water levels.	Current and Reduced Inflows: Some potential benefit to tribal assets if exposed tribal lands are suitable for agriculture or other purposes, or if lower water levels result in moving public boat launches onto tribal land. Economic benefits from use of Tribal lands for borrow pits. Significant but mitigable impacts may occur if use of borrow pits or other construction activities disturb mineral, cultural or other resources considered Indian Trust Assets.	Current and Reduced Inflows: Beneficial and significant impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Beneficial and significant impacts would be the same as described for Alternative 1.	Current and Reduced Inflows: Beneficial and significant impacts would be the same as described for Alternative 1.
Paleontological Resources					
Paleo. Resources	Current and Reduced Inflows: No impacts are expected.	Current and Reduced Inflows: Significant and mitigable effects may occur if construction activities disturb important fossils within the Lake Cahuilla Formation.	Current and Reduced Inflows: Significant and mitigable effects may occur if construction activities disturb important fossils within the Borrego Formation, Brawley Formation, or Pilocene-Pleistocene Nonmarine Sedimentary Deposits.	Current and Reduced Inflows: Significant and mitigable effects may occur if construction activities disturb important fossils within the Borrego Formation, Brawley Formation, or Palm Springs Formation.	Current and Reduced Inflows: Significant and mitigable effects may occur if construction activities disturb important fossils within the Lake Cahuilla Formation, Borrego Formation, Brawley Formation, or Palm Springs Formation.
Environmental Justice					
Env. Justice	Current and Reduced Inflows: Potential job losses would disproportionately	Current and Reduced Inflows: No disproportionate adverse impacts on health or the	Current and Reduced Inflows: No disproportionate adverse impacts on health or the	Current and Reduced Inflows: No disproportionate adverse impacts on health or the	Current and Reduced Inflows: No disproportionate adverse impacts on health or the

Table 2.9-1
Summary of Potential Environmental Consequences of Phase 1 Alternatives *(continued)*

Resource	No Action	Alternative 1	Alternatives 2 and 3	Alternative 4	Alternative 5
	impact low-income populations.	physical environment of minority or low income populations.	physical environment of minority or low income populations.	physical environment of minority or low income populations.	physical environment of minority or low income populations.

CHAPTER 3
AFFECTED ENVIRONMENT

This chapter is divided into resource sections covering all aspects of the human environment that may be affected by the Salton Sea Restoration Project. The focus is mainly on areas that would be affected by Phase 1 actions. Areas that may be affected by Phase II restoration activities are addressed in Chapter 6 at a programmatic level of detail, consistent with the level of planning information currently available.

Each of the resource sections includes an overview of the resource and the associated study area and a description of the affected environment for the various elements of the resource area. The sections are provided in sufficient detail for the reader to understand the environmental consequences of the program, as discussed in Chapter 4.

3.1 SURFACE WATER RESOURCES

3.1.1 Introduction and Scope of Discussion

The affected environment discussion for surface water resources at the Salton Sea includes surface water hydrology, water circulation patterns, water quality and salinity, and water use and management. The Phase I study area for surface water resources is defined by watershed boundaries of the Salton Basin. The Salton Sea watershed contains the Salton Sea and the Coachella and Imperial valleys. The Salton Sea is a terminal lake, with no outlet to the ocean. It receives sporadic inflow from precipitation. The bulk of the inflow is from agricultural and municipal drainage. The ultimate source of this most inflow is water imported to the region from the Colorado River.

The Phase I study area also includes that portion of the Colorado River and Delta below Imperial Dam that is affected by flood flows because up to 300,000 acre-feet of flood flows may be diverted in some years to the Salton Sea.

Water resources include both surface water and ground water resources. Surface water is simply the water exposed at earth's surface, and ground water is found beneath earth's surface at any particular time. Sometimes it is appropriate to view surface water and ground water together, as interactive parts of the hydrologic cycle. Thus, for example, some of the surface water applied to irrigate crops infiltrates and recharges the water in the ground. Some of this seepage may be intercepted by agricultural drainage tile systems, and some infiltrates to greater depths. The drains discharge to ditches and eventually to the Salton Sea. Similarly, because the Salton Sea Basin has no outlets for either surface or ground water, even the water that percolates to greater depths eventually flows to the Salton Sea through the subsurface. Thus, both surface water and ground water contribute to maintain the elevation of the Salton Sea.

3.1.2 The Salton Sea Watershed and Surface Water Hydrology

The watershed of the Salton Sea encompasses about 8,360 square miles. It includes a small corner of San Bernardino County that drains to the Whitewater River, some of Riverside County, most of Imperial County, the eastern portion of San Diego County, and part of the state of Baja California in the Republic of Mexico. The principal tributaries to the Salton Sea are the Whitewater River, which flows into the north end of the Sea, and the Alamo and New Rivers, which flow into the Sea from the south. The watershed is shown on Figure 3.1-1.

The Colorado River Basin Regional Water Quality Control Board (CRB-RWQCB) has divided the Salton Sea watershed into planning areas. With the exception of the southern boundary with Mexico, the boundaries of these planning areas are defined by hydrologic boundaries. In addition to the Salton Sea Planning Area, the study area includes the Coachella Valley Planning Area, the Imperial Valley Planning Area, and the Anza-Borrego Planning Area.

Only about three percent of the water that flows into the Salton Sea comes from rainfall within the watershed. Imperial and Coachella Valleys receive an average of about 2.3 and 2.8 inches of rainfall per year, respectively (MacGillivray 1980; 1981). Direct annual precipitation on the Salton Sea is estimated to be about 2.5 inches (Hely et al 1966). The Coyote Mountains east of the Salton Sea receive about eight inches per year. The upper San Jacinto and San Bernardino mountains west of the Salton Sea receive as much as 30 to 40 inches (CRB-RWQCB 1994). Most runoff occurs from November through April and from August through September. During the summer, most of the rainfall is from short, intense thunderstorms.

The total amount of water lost to evaporation from the Sea is currently estimated at about 1.36 MAFY, and since the elevation is approximately steady, this must be equivalent to the sum of the inflows. Table 3.1-1 shows the major sources of inflow to the Sea. The average tributary inflow values were calculated from published stream gage records for water years 1960/1961 through 1997/1998,

Table 3.1-1
Sources of Salton Sea Inflow

Source of Inflow	Total Average Annual Inflow (Acre-feet)	Percent Contribution of Total Inflow
Alamo River	620,000	46.1
New River	438,000	32.5
Agricultural Drains	106,000	7.9
Whitewater River	79,000	5.9
Ground Water	50,000	3.7
Direct Precipitation	46,500	3.5
San Felipe Creek	5,500	0.4
Salt Creek	1,000	0.1
Other	17,000	1.3
Total	1,346,000	100.0%

Source: USGS Stream gage data 1960-1998; Hely et al 1966; Ogden 1996

where available. (For example, the record for San Felipe Creek does not extend beyond 1991, and the record for Salt Creek begins in 1974). Agricultural drainage is the source of most of the New River, Alamo River, Whitewater River, and agricultural drain flows shown in Table 3.1-1.

The rate of ground water inflow was estimated by the U.S. Geological Survey (Hely et al 1966). At the time, it was estimated that about 30,000 AFY entered from Coachella Valley, and about 10,000 AFY were from flow beneath alluvium of San Felipe Creek. Only about 2,000 AFY was estimated to come from alluvium of the Imperial Valley. Ground water conditions in the Coachella Valley have changed since that time, and the current ground water component may be less than the estimate shown. Imperial Valley Drains are estimated to account for about 106,000 AFY (Ogden 1996). About 17,000 AFY in Table 3.1-1 represents inflow not otherwise accounted for. Of this amount, about 10,000 AFY may represent ungaged stream flow (Hely et al 1966).

The table suggests that more than 90 percent of the inflow to the Sea originates from sources outside the basin, mainly from the Colorado River. Some of the flow in the New River originates from Mexico. The average annual flow measured by the U.S Geoogical Survey in the New River at the International Border between 1980 and 1997, was about 182,000 AFY, and since the early 1960's, inflow from Mexico has contributed about 30 to 35 percent of the flow in the New River. By contrast, the Alamo River generally receives less than 2,000 AFY from Mexico, or less than 0.03 percent of its flow (Tetra Tech 1999).

The values shown in Table 3.1-1 are meant to illustrate the relative contributions of different sources of inflow, but the reader should not place too much emphasis on any single reported value. Older records do not necessarily reflect current water use and management patterns, and historical records that cover different periods of time may not be comparable. Flow records for the gage at the mouth of the New River are available from 1943 until the present. Annual flows in the New River have ranged from about 378,000 to 540,000 AFY during this period. The average annual flow in water years prior to 1960/1961 was about 474,000 AFY, and the average was about 451,000 AFY since 1960. Also, in water years from 1960 to 1998, discharge to the Salton Sea from the Alamo River averaged about 620,000 AFY, but ranged from 492,000 AF in 1986 to 718,000 AF in 1963. Similarly, although average inflows from Salt Creek since 1974 were about 4,000 AFY, discharge has declined to less than 1,000 AFY in recent years. Most of the flow in Salt Creek originates from seepage from unlined portions of the Coaschella Canal. If the Canal is relined, one of the mitigation measures may be to artifically supplement the flows in Salt Creek with releases from the canal (Tetra Tech 1999).

Development of the Salton Sea

The current Salton Sea was formed when flood flows from the Colorado River broke through a temporary diversion that had been designed to bypass the Imperial Canal. The Imperial Canal, which was routed from the Colorado River to the Imperial Valley through Mexico, was completed in 1901, but by 1904 it had become blocked by sediment. On October 11, 1905, a dike failed and nearly the entire flow of the Colorado River flowed uncontrolled into the Salton Basin for the next 18 months. It flooded the railroad line, railroad stations, and the salt works on the basin floor. When the breach was finally repaired in 1907, the elevation of the Salton Sea had reached –195 ft msl, and had a surface area of 520 square miles.

The rate of evaporation from the Salton Sea has been varioiusly estimated at between 5.5 to 6.5 feet per year (for example, see Ormat 1989; CVWD 1999a). For purposes of this report, the average annual rate is taken to be 69 inches (5.78 feet) per year, as estimated by the U.S. Geological Survey (Hely et al 1966). At this high rate of evaporation, the Salton Sea would have soon dried up, as lakes in the area have for thousands of years, had it not been for importation of water from outside the basin.

Figure 3.1-2 shows how the elevation of the Salton Sea has changed from 1907 until the present. As can be seen in the figure, the elevation has been fairly constant during the past 10 years or so. Since the inflow during any given period is equal to the change in volume of the Sea plus any losses that have occurred due to evaporation, a constant elevation indicates that the rate of inflow is approximately equal to the rate of evaporation. Although the average rate of inflow to the Salton Sea has averaged about 1.36 million af/yr for the past 50 years or so, the rate of inflow during any one year has ranged from between about 1.15 maf/yr

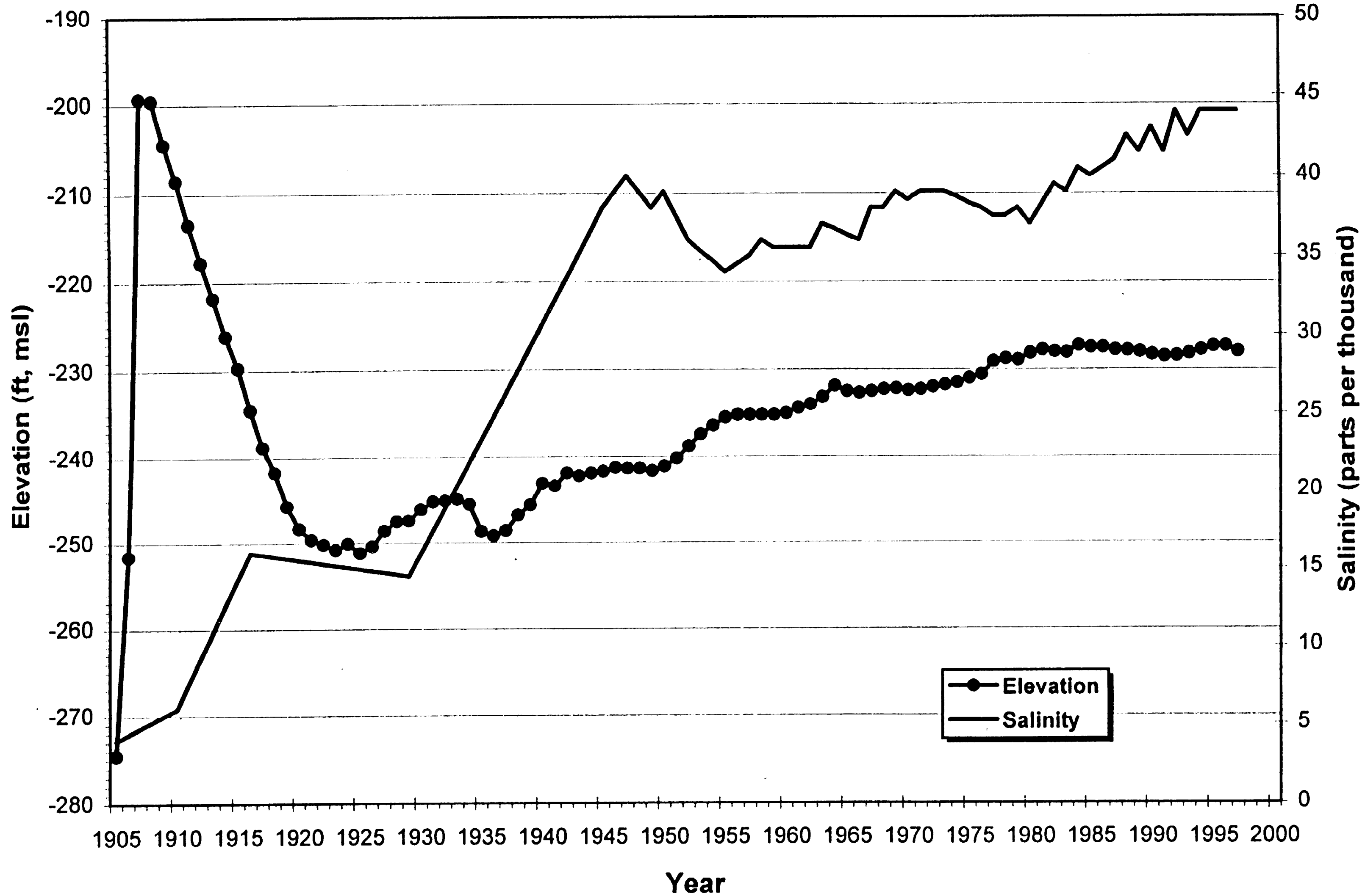


Figure 3.1-2 Historic Change in Elevation and Salinity of Salton Sea

and 1.65 maf/yr. Probably the main reason for the fluctuations in inflow are changes in cropping patterns in the Imperial, Coachella Valleys, and Mexicali valleys. Different crops consume different amounts of water. For example, in the Imperial Valley, evapotranspiration from alfalfa is estimated to consume about 80.6 inches of water (6.7 feet) per year, while citrus crops consume only about 46.1 inches (3.84 feet) per year (MacGillivray. 1980). Similar rates apply to the Coachella Valley. Variations in the amount of water that ends up in agricultural drains is, therefore, highly dependent on market forces.

3.1.3 Salton Sea Circulation

Studies of Salton Sea circulation recently have been conducted by the Water Resources and Environmental Modeling Group of the Department of Civil and Environmental Engineering (Modeling Group) at the University of California Davis (UC Davis), under contract to the Salton Sea Authority. The Modeling Group developed a model of the Salton Sea, based on an existing model called RMA-10, to predict the effects of Salton Sea Restoration Project alternatives on circulation patterns in the Sea (King 1998). These circulation patterns are believed to affect the distribution of nutrients, dissolved oxygen, mixing of fresh water, temperature gradients, and other water quality parameters in the Salton Sea, as well as to have a potential effect on shoreline erosion and sediment deposition patterns. A three-dimensional model was used to simulate current velocities that may vary with depth or that may be affected by differences in water density due to suspended sediment, temperature, and salinity. While the model is capable of accounting for many variables, it has been found that wind velocity is the dominant factor in creating the observed pattern of currents in the Salton Sea. The model was configured to account for the effects of the major tributary inflows from the Alamo River, New River, and Whitewater River and to simulate changes in salinity and temperature.

The model was calibrated to a set of field measurements of wind velocity, temperature, salinity, and current velocities obtained over the period from October 8 through October 29, 1997. A detailed description of the collection of the calibration data, and the calibration process, is presented in a report prepared by the Modeling Group (Cook, et al 1998), and is briefly summarized here.

The model consists of a finite element network designed to represent the physical boundaries of the system based on a detailed bathymetric survey conducted by the Bureau of Reclamation (Ferrari and Weghorst 1995). The motion of water in the Sea results from the transfer of energy, from wind, fresh water inflows, or solar heat, at network boundaries. The model solves equations describing the energy flow through the system, when certain physical properties of the system are mathematically defined. These properties include the roughness of the bottom, wind stress, inflow rates, etc. Some of these specified values are based on observation, and others are estimated through trial and error.

The accuracy of assumptions used in constructing the model were tested by calibrating the model against observed patterns of current velocity, conductivity (salinity), and temperature that developed in response to measured hydrologic and meteorologic conditions. It was found early in the calibration process, that the pattern of currents observed in the Sea is controlled primarily by wind velocity.

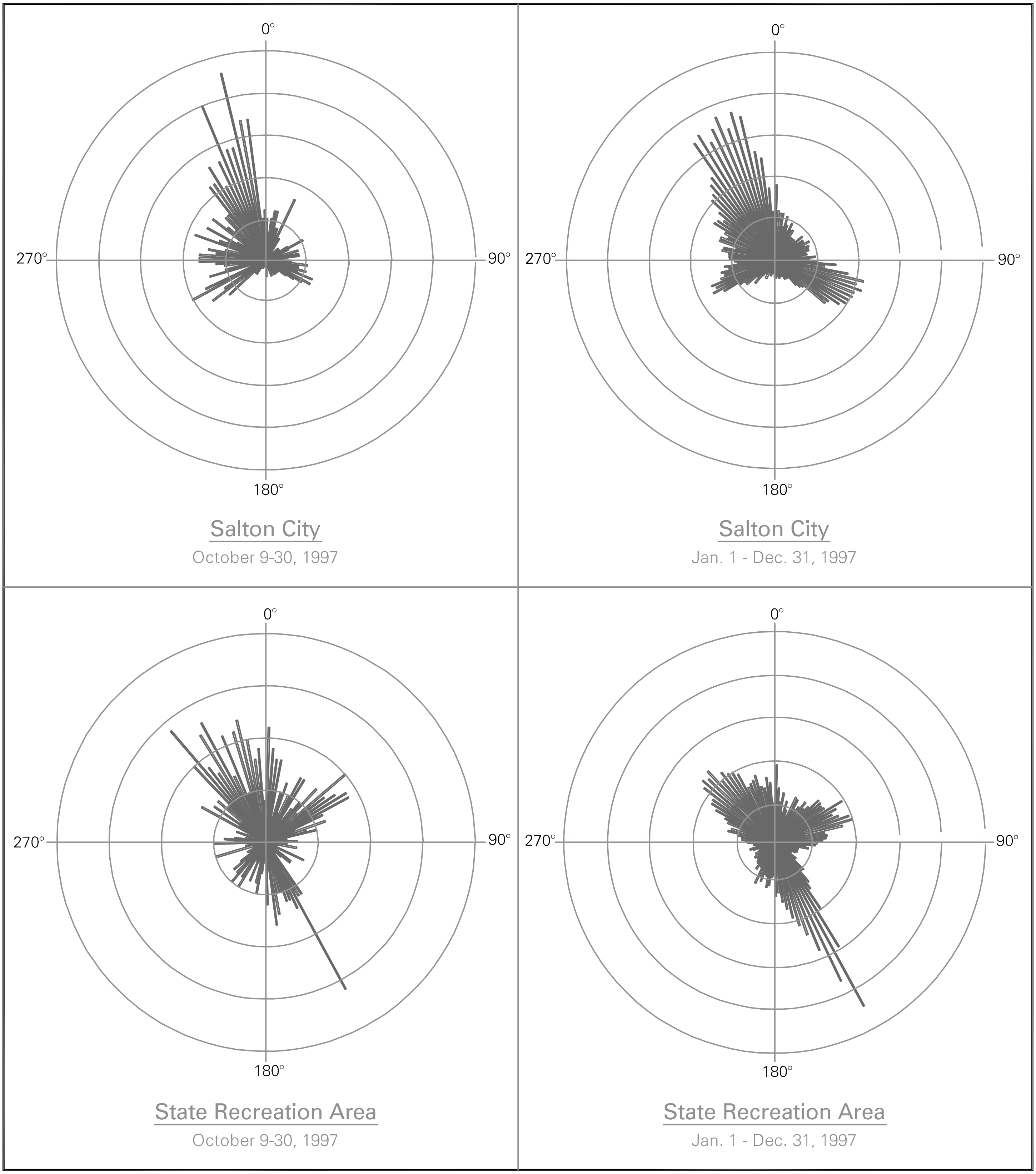
In order to investigate the changes in current patterns, salinity, and temperature that would occur if the elevation or shoreline geometry of the Sea were altered, model simulations were perfored using the same October 1997 meteorologic data set used in calibrating the model.

The predominant wind direction throughout the year, and the predominant wind direction observed in the October 1997 data, is from northwest to southeast, with a more pronounced eastward component across the southern portion of the Sea. Figure 3.1-3 shows wind rose diagrams illustrating the frequency with which wind was blowing during the period used as input to the hydrodynamic model, and over the entire year in 1997, using wind data from stations at Salton City (CMIS Station 127), and at the State Recreation Area on the northeast shore (CMIS Station 154). The diagrams show the direction from which the wind was blowing in 3 compass degree increments, sampled hourly. The length of the lines is proportional to the frequency.

During the modeled period, the average wind speed increased from less than about 3.4 mph in the northern end of the Sea to more than 7.8 mph in the southern end. Water current speeds were roughly one-tenth of wind speeds. Figure 3.1-4 illustrates the change in the model-simulated current speed at a point in the southern portion of the Sea. The location is roughly 4 miles northwest of the mouth of the Alamo River, but the pattern of change in current speed is fairly typical of any point in the southern part of the Sea, because it occurs in response to changes in wind speed. The two peaks in current speed on October 10, and on October 23, result from two storms that moved through the basin during this period.

The north-south wind pattern results in a pattern of currents dominated by two large gyres, rotating in opposite directions in each of the two "basins" of the Sea; in the northern basin, the currents rotate clockwise and in the southern basin, the currents rotate counterclockwise. The speed of rotation is typically much higher in the southern basin. Evidence of this pattern of currents has been observed in satellite photos of the Salton Sea. The model simulations, confirmed by field observations, suggest that the current velocity pattern near the surface of the Sea is much the same as near the bottom.

Fresh water is less dense than salt water, and in some estuary environments fresh water will "float" for a time over saltier water, creating a salt wedge at the mouth of a river, for example. However, in the Salton Sea, freshwater inflows from



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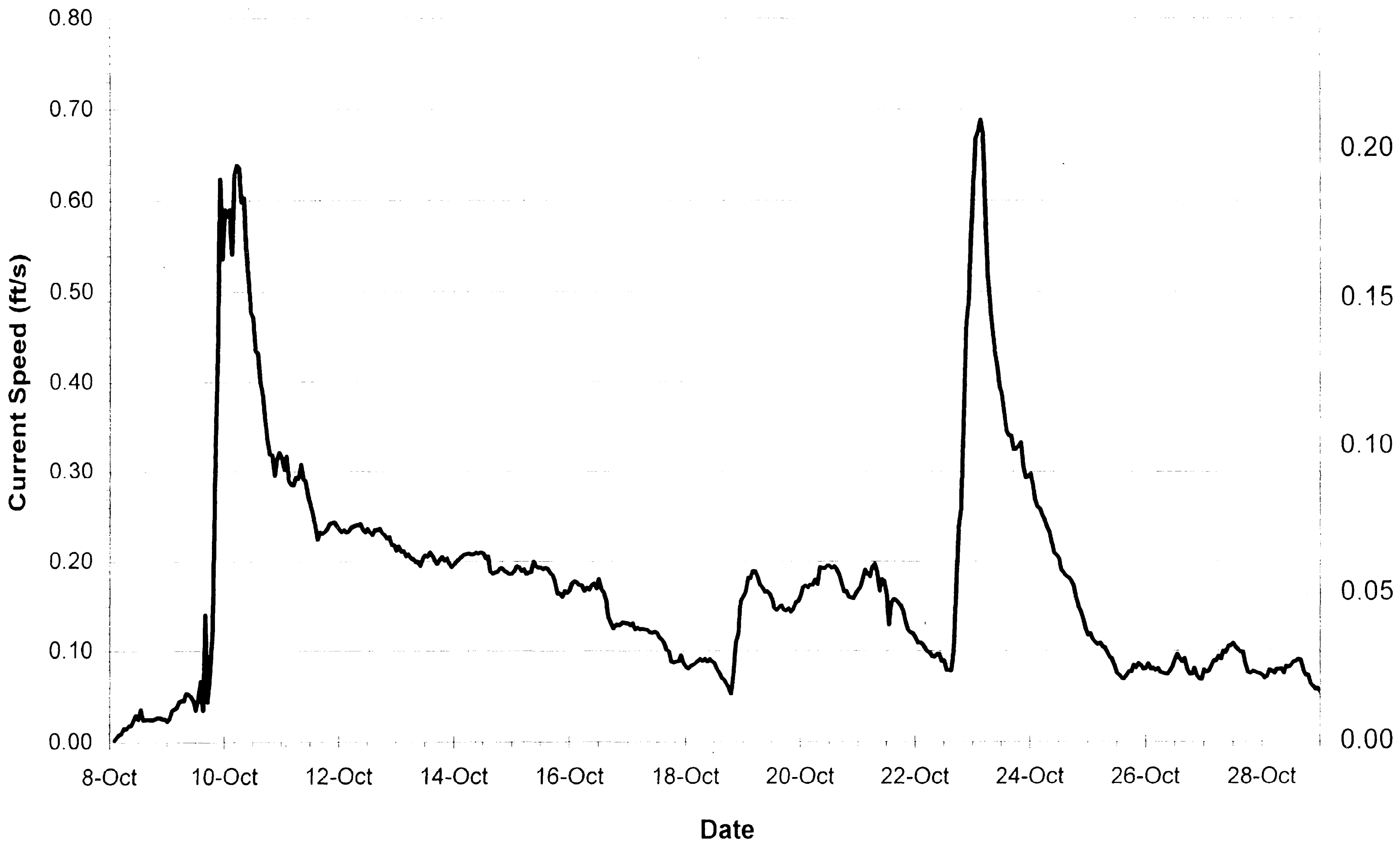
Diagrams show numerical frequency of hourly wind directions plotted by the direction from which wind blows. Length of lines are proportional to number of observations per 3-degree compass sector.

Wind Rose Diagrams for October 9 - 30 and for Year at Two Locations

Salton Sea, California

Figure 3.1-3

Figure 3.1-4 Example of Variation in Current Speed
Surface of Salton Sea (-227 ft msl)
October 9 - 27, 1997 (Node 109) Offshore of Alamo River



tributaries mix rapidly with the ambient salt water, forming a fairly abrupt transition from freshwater to salt water. Thus, with respect ot salinity, and probably all dissolved constituents, the Sea is remarkably homogeous throughout its volume, within a short distance of the mouths of tributaries.

3.1.4 Water Quality and Salinity of the Salton Sea

The Salton Sea is a repository for agricultural and municipal wastewater. In 1998, the Salton Sea was listed by the CRB-RWQCB as an impaired surface water body, in accordance with Section 303(d) of the Clean Water Act. Four of the tributaries to the Salton Sea also are listed as impaired: the New River, the Alamo River, the Coachella Valley Stormwater Channel, and the Imperial Valley Drains (CRB-RWQCB 1998 [#10, pp 2-3]). During the 1960's and 1970's, body contact recreation (swimming, water skiing, etc.), was an important beneficial use of the Sea. As a result, body contact recreation remains one of the listed beneficial uses protected by the Colorado River Region Basin Plan.

The Salton Sea is a sump not only for the water that flows into the Sea but also for all of the salts, sediments, and other constituents dissolved in or transported by that water. These constituents constitute the "load" transported to the Sea by the various sorces of inflow. The quantity of constituents per unit volume of water is the "concentration" of the constituents. However, the loading rate depends on both the concentration and the rate of flow. A small flow containing a high concentration can result in the same loading as a high flow containing a lower concentration. The concept of loading has special significance because under the Clean Water Act state regulatory agencies must begin defining "total maximum daily loads" (TMDLs) for constituents believed to adversely affect receiving waters that have been identified as having impaired water quality. The purpose of setting TMDLs is to achieve water quality standards in impaired water bodies, where many sources contribute to the impairment. Currently, the CRB-RWQCB plans to define TMDLs for selenium, salt, and nutrients flowing into the Salton Sea. The target date for the salt TMDL is 2001, for the selenium TMDL is 2007, and for the nutrient TMDL is 2010. In addition, TMDLs are planned for pesticides, silt, bacteria, nutrients, and volatile organic compounds in the New River; for pesticides, selenium, and silt in the Alamo River; for pesticides, selenium, and silt in Imperial County drains; and for bacteria in the Coachella Valley Stormwater Channel. The silt TMDLs will be developed first for the Alamo River and Imperial County Drains, which are targeted for completion in 2000. The silt TMDL for the New River is targeted for completion in 2002, and the TMDL for bacteria in the New River is targeted for completion in 2005 (RWQCB 1999).

Salinity

Units of Concentration. Before discussing salinity, it is important to clarify the the units of measure that salinity values are reported in. Concentrations of dissolved constituents are frequently given in terms of the weight of the constituents per weight of a volume of water. Typically the metric system is used because metric units are easy to use. Two types of concentrations are used widely in reports. One type of concentration is the mass of dissolved substance per unit mass of solution. This type of concentration unit is commonly used for salinity measurements, which are frequently given in parts of salt per thousand parts of solution, (parts per thousand, or ppt). The other commonly used type of concentration gives the mass of dissolved substance per unit volume of solution. Units of miligrams per liter (mg/L) are commonly used. Pure water weighs 1,000 grams per liter, and there are 1,000 milligrams in a gram. So when the substance is dissolved in water and the concentration is low, milligrams per liter volume are nearly equivalent to parts per million mass (ppm). However, when the concentration is high, such as in the range of concentrations of Salton Sea water, a liter of solution weighs significantly more than a liter of pure water. For example, the current concentration of Salton Sea water, 44,000 mg/L, is equivalent to a salinity of about 42.5 ppt, and a salinity of 60 ppt is equivalent to about 63.3 mg/L. In this report, all concentrations are reported in units of mass per volume of solution, and mass per mass concentrations have been converted.

In addition to the confusion that may occur because of the two reporting methods, the way in which salinity measurements are made can also confuse the issue. The concentration of all of the dissolved salts in a solution is known as "total dissolved salts" or TDS for short. Technically, however, salinity is defined by comparing the electrical conductivity of an unknown solution to the electrical conductivity of a known solution of potassium chloride that has similar electrical properties to ocean water. Electrical conductivity measurements can be made rapidly, at low cost, and in place in the field, using a hand-held conductivity instrument. Direct measurement of the mass of dissolved solids in a solution requires that a samle be collected and the analysis be done in a laboratory. For many purposes, the results obtained from the two methods are similar. The concentration of dissolved solids can be estimated from conductivity measurements if the correct conversion factor is used (which depends on the concentration, nature of the dissolved solids, and in some cases, on the temperature). The lack of standardization in the way that concentrations have been reported in the past probably introduces uncertainty of several percent in the reported values.

Salinity Trends in the Salton Sea. The Salton Sea has no outlet, so the salt load and the loads of some other constituents entering the Salton Sea accumulate in the Sea. With an evaporation rate of 5.78 feet per year, the entire volume of the Salton Sea, with its maximum depth currently at about 50 feet, would evaporate within about 10 years if all inflow sources were stopped.

There is no question that the salinity of the Sea will continue to increase as dissolved salts are carried into the Sea and are concentrated by evaporation. However, the relative proportions of dissolved constituents that contribute to the salinity will continue to change because the proportions of the constituents in the inflow differ from the proportions in the Sea, and because some of the constituents are precipitated from the water by biological and chemical processes. Thus, for example, calcium carbonate is removed in the formation of shells and skeletons of organisms or by chemical precipitation enhanced by certain algae. Similarly, calcium and magnesium sulfates will be chemically precipitated as the concentrations of these compounds reach the limits of their solubilities in Sea water. It is difficult to accurately predict the rates at which the individual chemical constituents will precipitate because solubilities vary depending on the chemical species present and their concentrations, along with many other factors. Some of these other factors, including the water temperature, organisms, pH, dissolved gases, dissolved and suspended organic and particulate matter, oxydation-reduction potential, may be constantly changing. In general, however, the Sea is expected to become enriched in the constituents that are most soluble in water, such as sodium, potassium, and chloride, and to become depleted in the constituents that form insoluble compounds, such as calcium.

The proportions of the major salt constituents in the inflow to the Sea vary by source. Sodium and chloride are the principal constituents of inflow from the New River, while sodium and sulfate are the principal constituents of Whitewater and Alamo River inflows. Overall, these four constituents, along with bicarbonate (which is replenished from atmospheric carbon dioxide), represent the bulk of the dissolved material entering the Sea.

In 1966, the U.S. Geological Survey published a detailed study of the historical hydrologic regime of the Salton Sea, including an estimate of the water budget (inflows and outflows from various sources), changes in elevation over time, and an evaluation of the major dissolved constituents and temperature profiles (Hely et al 1966). They showed that the salinity increased rapidly between 1907 and about 1925, as the existing salt pan on the basin floor dissolved in the Sea, and the salts were concentrated in a decreasing volume. By 1923 the elevation of the Sea had declined to about –255 ft msl, and the salinity had reached a peak of about 37,600 mg/L. Subsequently, inflows to the Sea increased, and the elevation (and volume) of the Sea began to increase. As a result, salinity fluctuated between about 31,000 and 39,000 mg/L during the next 40 years. During this period however, the total mass of salts in the Sea continued to increase. The average concentrations of major ionic constituents measured by the U.S. Geological Survey in four sampling rounds between September 1962 and May 1964 are shown in Table 3.1-2.

Table 3.1-2
Average Concentrations of Major Ions (mg/L) in Salton Sea, 1962-1964

Calcium	Magnesium	Sodium	Bicarbonate	Sulfate	Chloride	TDS
786	972	9,743	176	7,130	13,825	32,525

Source: Hely et al, 1966

Between 1980 and 1993 the Regional Water Quality Control Board conducted sampling of tributaries, drains, and the Salton Sea itself, at a point near the middle near the county line. The number of samples from the Salton Sea varied, but for many of the parameters about 35 to 40 samples were collected. The focus of the sampling program was on parameters other than major ions. However, sulfate was included among the analytical parameters. Nine samples were analyzed for sulfate. The concentration ranged from about 9,000 to 12,000 mg/L during the sampling period. The concentration steadily increased until 1990, when it reached the peak value. From 1990 to 1993, the concentration fluctuated between 10,000 and 12,000 mg/L. The fluctuation in concentration may have been related to changes in inflow rather than to control by precipitation of gypsum, however.

The composition of Salton Sea water has recently been monitored at three locations in the Sea and at the mouths of the three major tributaries, in a reconnaissance study currently being conducted for the Salton Sea Science Subcommittee (Holdren 1999). The summary results for major ionic constituents are presented in Table 3.1-3. Although samples were collected at different depth intervals, the results indicate that the water is chemically well mixed, and the samples from different depths have been averaged together in Table 3.1-3. The lack of increase in the concentration of sulfate since 1992 may be an indication that the sulfate concentration is limited by the solubility of gypsum.

Table 3.1-3
Average Concentrations of Major Ions (mg/L) in Salton Sea, January to July, 1999

Calcium	Magnesium	Sodium	Bicarbonate	Sulfate	Chloride	TDS
1,006	1,384	12,356	246	11,236	16332	43,277

Source: Holdren, 1999

Other Water Quality Constituents

As discussed above, the inflows to the Sea derive mainly from agricultural and municipal wastewater, with a relatively small component of natural storm drainage. Water used in irrigation comes into contact with various agricultural chemicals and fertilizers, as well as the natural mineral and organic substances contained in soils. Municipal waste water, depending on the degree of treatment it receives, contains varying amounts of dissolved and suspended organic material, nutrients, metals, hydrocarbons and other compounds that originate from domestic, industrial, and urban runoff sources. The water also carries with it a certain amount of sediment derived from soil erosion. Therefore, while most of the salts discussed in the previous section originate from the Colorado River and are simply concentrated due to evaporation, other constituents are added to the water from sources inside the basin.

The earliest detailed study of constituents other than salts was performed by Carpelan (1958; 1961) during a one-year period between July 1954 and July 1956. In addition to reviewing historical data on the major ion composition of the Sea, these studies presented depth profiles of temperature, dissolved oxygen and pH. Nutrient concentrations (ammonia, nitrate, and phosphates) were measured in samples from depths near the surface and near the bottom at four locations in the Sea. The results of nutrient analyses indicated that there were significant differences in concentrations depending on depth and location. For example, water samples from near the bottom were much higher in concentrations of ammonia and phosphate than were samples from near the surface, and samples from near Mullet Island contained higher concentrations of nutrients than samples from mid-Sea locations.

During the period from 1963 to 1969 the Federal Water Quality Administration (FWQA) and the California Deparment of Water Resources conducted a study of nutrient loading and its effects on the Sea (FWQA. 1970). The report described the Sea as eutrophic, meaning that nutrient concentrations caused high rates of algal growth, leading to high concentrations of dissolved oxygen in near-surface waters and oxygen depletion in waters at depth.

An issue of general concern at this time was the potential for persistent pesticides and herbicides from agricultural practices to enter the ecosystem. The U.S. Geological Survey performed a study of pesticide and herbicide inputs to the Salton Sea during the period from August 1969 to June 1970 (Irwin, 1971). Samples were collected from the New and Alamo Rivers and the All American and East Highline Canals. The results showed that a number of pesticides were present in the inflows to the Salton Sea. DDT and its degradation products, dieldrin, methyl parathion, 2,4-D, and Silvex were reported in most of the samples collected from near the outlets of the New and Alamo Rivers. Other pesticides and herbicides were also reported, but with less frequency.

Partly as a result of observations of the effects of selenium on waterfowl at the Kesterson Reservoir in the San Joaquin Valley, the U.S. Geological Survey initiated a series of studies in 1985 as part of the National Irrigation Water-Quality Program. The Regional Water Quality Control Board had concluded in 1985 that tile drains were the main source of selenium in the Imperial Valley, although concentrations of selenium as high as 0.029 mg/L were also found in San Felipe Creek (Setmire 1998). Subsequent sampling of drain water by the U.S. Geological Survey in 1986 confirmed that selenium concentrations were highest in tilewater, but were generally below the drinking water standard in collector drains, and were less than 0.002 mg/L in both the Colorado River and in the Salton Sea. The U.S. Geological Survey studies continued until 1995 (Setmire et al. 1990; Setmire et al., 1993; Setmire and Schroeder, 1998). Although the principal objective of these studies was to investigate sources of selenium in agricultural drain water, other constituents, including trace elements, major ions, nutrients, pesticides and herbicides, were also assessed. The focus of the studies, however, was on identifying sources, rather than evaluating water quality of the Salton Sea itself. The U.S. Geological Survey studies concluded that the selenium found in drain water originates from the water imported from the Colorado River, but is concentrated, along with other salts, by evapotranspiration. Thus, the loading to the Sea would be a function of the amount of Colorado River water imported, rather than the leaching of selenium from minerals in the soil.

In addition to selenium, arsenic, boron, mercury and other parameters were investigated. Results of sampling at stations in the National Stream Quality Accounting Network in the Imperial Valley have shown that arsenic occassionally exceeds the U.S. EPA water quality criterion for protection of aquatic life of 0.005 mg/L in the New River. Further studies by Setmire et al (1993) suggested that the arsenic might originate from ground water sources within the basin.

In addition to the studies described above, various agencies have collected, or continue to collect data that are not widely disseminated. The Coachella Valley Water District has collected data on major ions and heavy metals in drain water since the 1960's. The Imperial Irrigation District has collected major ion data at selected locations, including five shoreline stations, twice a year. The Regional Water Quality Control Board collected data for various contaminants and water quality indicators from the tributaries, drains, and from the center of the Sea, from 1980 to 1990.

Table 3.1-4 presents summary statistics for selected analytes. The results indicate that the Alamo and New Rivers are a source of nitrogen loading to the Sea. Phosphate concentrations in the Sea are similar to those in the tributaries. Chemical and biological oxygen demand (COD and BOD, respectively) are higher in the Sea than in the tributaries. These are measures of the amount of biological and non-biological matter capable of using up dissolved oxygen. The range of dissolved oxygen concentrations in the Sea tends to be wider than in the tributaries. However, other studies have indicated that dissolved oxygen in the Sea decreases rapidly with depth, and concentrations are often close to zero at depths of 10 feet or more.

In addition to the parameters shown in Table 3.1-4, the samples were analyzed for suspended and settleable solids, pH, and other parameters. A few samples were analyzed for selected metals. For example, two samples were analysed for selenium. The concentrations of the two samples were 0.002 and 0.005 mg/L (2 to 5 parts per billion, respectively).

Table 3.1-4 also indicates that the New and Alamo Rivers contain large amounts of bacteria relative to the Sea. Fecal coliform bacteria are an indicator of human waste, but may not survive in the highly saline conditions found in the Sea. In addition to the data gathered by the Regional Board, IID has been sampling for coliform bacteria at a number of nearshore stations around the Sea. Further discussion of public health issues is presented in Section 3.14.

Table 3.1-4
Comparison of Selected Water Quality Results (mg/L) in Tributaries and Salton Sea, 1980-1993

	Ammonia	Nitrate	Phosphate	BOD	Dissolved Oxygen	Fecal Coliform (1)	COD
Salton Sea							
n	37	36	38	39	35	40	36
Average	0.83	0.19	0.34	13	10.8	3.08	401
Maximum	3.00	1.00	1.42	51	20	20	2,192
Minimum	0.01	0.005	0.03	2	.07	2	65
New River							
n	38	38	38	39	35	40	39
Average	1.50	4.96	0.89	8.66	6.20	15,640	42.9
Maximum	3.50	17	1.86	17	9.3	160,000	143
Minimum	0.22	1.5	0.01	3.0	3.6	500	12
Alamo River							
n	39	38	37	39	35	40	39

Average	1.04	8.05	0.68	5.93	7.66	16,102	37.8
Maximum	2.86	24	2.04	26	10.2	240,000	143
Minimum	0.28	3.9	0.12	2.0	5.2	170	10
Whitewater River							
n	39	38	38	39	37	39	39
Average	0.23	0.50	0.24	1.91	9.71	86.6	7.97
Maximum	1.20	1.9	2.0	11	15.3	540	39
Minimum	0.01	0.06	0.02	1.0	7.1	2.0	1.0

Source: CRB-RWQCB, 1999; (1) fecal coliform reported in units of MPN/100 ml

As described above, a reconnaissance water quality study of the Salton Sea is currently being conducted for the Salton Sea Science Subcommittee. Preliminary results of those studies, covering the period from January to July, 1999, are summarized in Table 3.1-5. The results are generally in accord with the results of trend monitoring by the Regional Water Board from 1980 to 1993.

Table 3.1-5
Average Concentrations of Nutrients and Selenium (mg/L) in Salton Sea, January to July, 1999

Total Alkalinity	Ammonia Nitrogen	Nitrate/ Nitrite	Total Phosphorous	Total Suspended Solids	Selenium
258	1.072	0.174	0.07	39	0.0011

Source: Holdren, 1999

The low concentration of selenium in the Salton Sea, relative to its concentration in the drains and tributaries suggests that there is a mechanism for removal of selenium at work in the Sea. Analysis of sediment samples reveals that the concentration of selenium is generally two or three times greater in bottom sediments from the Salton Sea than in sediments in upstream locations. Selenium may be taken up by bacteria, and chemically reduced. The reduced forms of selenium (selinite, elemental selenium, and hydrogen selenide) are lesss soluble in water than the selenate. Also, selenium may be incorporated by biological reactions in organic molecules capable of volatilizing to the atmosphere. Alternatively, some of the selenium may precipitate with dead plant material, or it may even chemically precipitate under the low-oxygen conditions found at the bottom of the Sea.

Although elevated concentrations of selenium, boron, and pesticides were found in tissue samples of waterfowl and fish, direct exposure to these contaminants in water does not appear to be an important exposure route. Rather, birds probably ingest fish, sediments, plants, or other organisms in which the compounds have become concentrated.

Other Water Quality Parameters. As part of the restoration program, Reclamation has been collecting samples in 1999 from three stations in the Salton Sea and from each of the three major tributaries: the Alamo River, the New River, and the Whitewater River. The following preliminary findings are based on this data:

- With the exception of total suspended solids, concentrations of most measured components are much lower, and much more variable, in the three river stations than in the Sea.
- The Alamo and New Rivers carry a very heavy sediment load., with total suspended solids concentrations usually greater than 200 mg/L. Suspended solids levels in the Whitewater River are lower than in the other two rivers, but are still usually greater than 100 mg/L.
- Thermal stratification occurs in the Salton Sea, with observed differences between surface and bottom temperatures of up to 8 EC. The stratification is not stable, however, and both depth of stratification and temperature differences between surface and bottom waters vary.
- Dissolved oxygen levels are usually above saturation concentrations as a result of photosynthesis in the surface waters. In contrast, dissolved oxygen levels near the bottom of the lake are frequently less than 1 mg/L.
- The oxidation-reduction potential is negative in areas with low dissolved oxygen.
- Phosphorus appears to be the nutrient limiting algal growth in the Salton Sea. Dissolved orthophosphate concentrations have been below the detection limit of 0.005 mg/L on several occasions and the maximum observed value is only 0.035 mg/L.
- Very high nitrate-N concentrations occur in the river samples. Nitrate concentrations in New and Alamo Rivers are usually beween 3 and 7 mg/L, while concentrations in the Whitewater River are usually between 12 and 15 mg/L. The latter concentrations exceed the drinking water standard of 10 mg/L.
- In contrast to the high nitrate levels in the river samples, most nitrate concentrations observed in the lake samples have been less than 0.2 mg/L. Denitrification in the bottom waters of the lake and algal uptake from the surface waters are the most likely explanations for the observed results.
- Ammonia-N concentrations in both river and lake samples are relatively high for surface waters. These high ammonia concentrations in the lake, which are frequently greater than 1 mg/L, coupled with typical pH levels around 8.3 in the surface water, are of potential concern to the lake's fishery. Although un-ionized ammonia concentrations do not appear to be reaching toxic levels, un-ionized ammonia may combine with other stressors, such as low dissolved oxygen concentration and high temperatures to contribute to fish kills in the lake.
- Dissolved organic carbon and dissolved silica levels in the Salton Sea are relatively stable. Dissolved organic carbon is usually around 45 mg/L, while most dissolved Si concentrations are between 5 and 7 mg/L.

- Sodium is the dominant cation in the Salton Sea. It is likely that calcium and magnesium concentrations are being at least partially controlled through precipitation reactions.
- Chloride and sulfate are the dominant anions in the system. Carbonate is present at relatively low concentrations and is probably being limited through precipitation as $CaCO3$. Some sulfate salts are also relatively insoluble, and the precipitation of sulfates may help slow future increases in salinity if water inputs drop. Fluorides may also be precipitating, but fluoride concentrations are uncertain and are being re-checked.
- Trace metal concentrations do not appear to be of major concern in the Sea itself (most metals are being re-analyzed). Dissolved selenium concentrations ranged from 2.55 micrograms per liter in the Whitewater River to 5.89 micrograms per liter in the Alamo River, which are high enough to be of concern. Concentrations were lower in the lake samples, however, ranging from 1.02 to 1.25 micrograms per liter. Selenium concentrations were similar in dissolved and total fractions, indicating that most Se is present in dissolved forms.
- Concentrations of semi-volatile organics and chlorinated pesticides/PCBs were below analytical detection limits for both river and lake samples.

3.1.5 Water Use and Management

The use and management of water in the Salton Sea watershed is affected by the complex interaction or water regulations and the needs of the water users. Water use and management issues include water rights, water imports and distribution, irrigation and drainage, and water conservation.

Water Rights

The rights of the Colorado River Seven States and Mexico to use Colorado River water is governed by a body of permits, agreements, contracts, court decrees, acts, laws, and treaties collectively referred to as the "Law of the River" or "Colorado River Law." The use of the water has been allocated by Supreme court decrees, the California Seven-Party Agreement, contracts with the Secretary of the Interior, and agreements among water entitlement holders.

The Colorado River Compact of 1922 provided for the allocation of 15 maf of Colorado River water per year for beneficial use in the Seven Basin States of Arizona, California, Colorado, Nevada, New Mexico, Wyoming, and Utah, with 7.5 maf being apportioned to the three Lower Basin States of Arizona, California, and Nevada.

The Boulder Canyon Project Act of 1928 authorized the construction of Hoover Dam, Imperial Diversion Dam, and the All-American Canal. The Act provided for the division of the lower basin's 7.5 maf apportionment, which were later solidified via the Secretary's contracts and confirmation in the 1963 Arizona V. California et al Supreme Court decision. Therefore, the three lower basin apportionments to Colorado River

Water per year are as follows: Arizona 2.8 maf and 46 percent of any surplus, California 4.4 maf and 50 percent of any surplus, and Nevada .3 maf and 4 percent of any surplus. The Act requires all non federal Colorado River water users to have a contract with the Secretary of the Interior for use of Colorado River water.

The Law of the River has allocated the first right to use Colorado River water of 131,400 acre- feet per year to five Indian Communities located along the Colorado River, and another 5,001 acre-feet to Miscellaneous present perfected rights holders.

In 1931, the seven major California Colorado River Water users (Palo Verde Irrigation District, City of Los Angeles, Imperial Irrigation District, Coachella Valley Irrigation District, the Metropolitan Water District, and the City and County of San Diego), signed an agreement setting the water right priorities for the allocation of California's apportionment of Colorado River water. This allocation was adopted by the Secretary in a general regulation and incorporated into the water delivery contracts. Under the California-Seven Party Agreement, agriculture users hold entitlements to the next 3,850,000 acre-feet of Colorado River water use. When available, the Metropolitan Water District of Southern California has an entitlement to 1,212,000 acre-feet of water for use in Southern California, then another 300,000 acre-feet for agriculture, and 1,000 acre-feet for the Bureau of Land Management. California's use of Colorado River water has, therefore, exceeded 4.4 maf when the water was available.

Under the Mexican water Treaty of 1944, as provided for in the 1922 compact and the Boulder Canyon Project Act of 1928, Mexico has an apportionment of 1.5 maf per year in a normal year and the possibility of as much as 1.7 maf when available, and is required to take a shortage in a less than normal year. As provided for in the 1922 Compact if the United States shall recognize the right of Mexico to the use of any water of the Colorado River System, such waters shall be first supplied from the waters which are surplus over and above the 15 maf. It also provided that if such surplus shall prove insufficient for this purpose, the Mexican deficiency is to be borne equally by the Upper and Lower Basins. In effect the treaty increased the apportioned amount of Colorado River water from 15 maf to 16.5 maf per year.

In 1946, the City and County of San Diego assigned its entitlement of Colorado River water to The Metropolitan Water District of Southern California.

In 1968, the Colorado River Basin Project Act which authorized the construction of the Central Arizona Project gave California's 4.4 maf year apportionment priority over the Central Arizona Project's use of Colorado River water in times of shortage.

Water Imports and Distribution

The water allocated to the Imperial and Coachella valleys is diverted via the All American Canal from a point of diversion at the Imperial Dam in Yuma, Arizona. The canal is about 80 miles long and runs roughly parallel to the border with Mexico to the western edge of the Imperial Valley. When it was constructed in 1940, the canal was unlined; because of this, it leaks large quantities of water into the sand sediments it crosses. Reclamation estimates that about 68,000 af/yr of water could be conserved by lining the canal from Pilot Knob near Yuma to Drop 4 on the East Mesa, about three miles east of the point of diversion to the East Highline Canal (Bureau of Reclamation 1994).

About 20 miles west of Yuma, at Drop 1, the Coachella Canal branches from the All American Canal and heads north. The design capacity of the All American Canal above Drop 1 is 10,155 cfs. About 86 percent of the water in the All American Canal is used in the Imperial Valley, and about 14 percent is used in the Coachella Valley (CRB-RWQCB 1992).

The Coachella Canal is about 123 miles long, all but 32 miles of which has been lined. Between 1960 and 1980, the flow in the Coachella Canal measured at the All American Canal ranged from about 500,000 af/yr to 600,000 af/yr. During the 1980s, the flows averaged closer to 400,000 af/yr (CRB-RWQCB 1992). DWR (1994) estimated that the agricultural water demand in the Coachella Valley in 1990 was about 300,000 af/yr, while urban water demand was about 200,000 af/yr. All of the municipal water supplies in the Coachella Valley are from ground water (CRB-RWQCB 1992).

Below Drop 1, the capacity of the All American Canal is about 7,600 cfs (Bureau of Reclamation 1994).

Between 1960 and 1990, IID's share of the flow in the All American Canal ranged from about 3.1 maf/yr to about 2.5 maf/yr. IID supplies about 98 percent of the water it receives to agriculture, while about two percent is used for domestic purposes (IID 1997). IID supplies water to the cities of Calexico, Holtville, El Centro, Imperial, Brawley, Westmorland, Calipatria, Niland, Seeley, and Heber. The actual discharge in the All American Canal below Drop 1 varies from about 2,000 cfs in January to about 5,000 cfs in May. Between April and October, it generally remains above 4,250 cfs (Bureau of Reclamation 1994).

Within the Imperial Valley, irrigation water is distributed through about 1,500 miles of canal.s and laterals, to about 79,000 acres of farmland (Setmire, 1998). Different crops require different amounts of water. In 1995, about 80 percent of the irrigated cropland was planted with field crops (e.g., alfalfa, wheat, sudan grass, sugar beets), of which about 30,000 acres was in alfalfa. About 17 percent was planted in garden crops (e.g., lettuce and carrots).

In order to maintain the flow of water through the canals, water in excess of the amount needed for irrigation is required. This "operational loss" water does not get applied to fields, and eventually discharges to drains. It represents about 15 percent of the flow in the Alamo River at the outlet to the Salton Sea (Setmire, 1998). Some of the water that is applied to fields by flood irrigation methods discharges to drains at the tail of the field. This "tailwater" has about the same composition as the applied water, although it tends to have a higher load of silt, pesticides, and nutrients through contact with the ground surface. The remaining water either infiltrates or is lost to evapotranspiration. Much of the water that infiltrates is collected in subsurface tile drains designed to prevent the water table from rising into the root zone of the crops. The "tile" water discharges to a network of about 1,300 miles of drains that discharge to the New or Alamo Rivers, or directly to the Salton Sea (Setmire 1998). According to Setmire (1998), nearly all of the flow in the Alamo River results from tile water, operation loss, canal seepage, tailwater, and occasional storm water. Setmire (1998) estimated that about 25 percent of the water in the Alamo River came from tilewater in 1995, while the remainder comes from water with about the same composition as Colorado River water.

A portion of the water imported to the Salton Basin is used to maintain wetlands and wildlife areas. DWR (1994) has estimated the total environmental water needs at about 40,000 AFY, nearly as much as domestic water use in the Imperial Valley.

Inflows from Mexico via the Alamo and New River from 1960 until 1978 were fairly constant, at about 0.1 maf/yr. During the 1980s, inflows from Mexico increased to as high as about 0.4 maf/yr (CRB-RWQCB). By the treaty of 1944, Mexico is guaranteed 1.5 maf/yr of the flows in the Colorado River. However, in recent years Mexico has received more than this amount because of unusually high runoff in the Colorado River. From 1983 to 1986, for example, Mexico received more than 45 MAF, or an average of about 11 maf/yr (CRB-RWQCB 1992). Some of the excess flows were diverted to the Mexicali Valley for irrigation and ground water recharge, and this contributed to the higher than usual flows observed between 1983 and 1986.

Irrigation and Drainage

The presence of fine-grained soils requires farmers in most of the Imperial Valley to install subsurface drain systems to prevent waterlogging and accumulation of salts in shallow soils irrigated by flood irrigation methods. In this type of irrigation system, water is applied at the head of the field and is allowed to flow downslope to a drainage ditch and sump at the tail end of the field. The design of the irrigation and drainage system depends mainly on the properties of soils and the slope of the field. Slopes can be adjusted by leveling to achieve optimum infiltration rates. For clayey soils with relatively flat slopes, the distance from head to tail of the field can be as much as a half mile. For sandy soils, the distance may be 300 feet or less (Setmire 1993).

Ideally, most of the applied water should percolate through the soil, and very little water should flow into the ditches at the tail of the field (tail water). The water applied to the field accomplishes several objectives. The amount of water applied maintains plant growth and offsets water lost through the leaves of the plants (transpiration) and from direct evaporation. (The combination of evaporation and transpiration is called evapotranspiration.) Different crops consume different amounts of water. For example, alfalfa consumes about 5.2 AF/acre, cotton consumes 3.45 AF/acre, tomatoes require 2.23 AF/acre, and carrots use about 1.21 AF/acre (Imperial County 1997). On average, there are 525,000 acres, requiring 1.77 MAF of water, under cultivation each year in Imperial Valley, representing an average agricultural water consumption rate of 3.37 AF/acre (Imperial County 1997).

Evapotranspiration causes the salts that were already in the irrigation water or those that dissolve from the soils to accumulate in the root zone of the plants. To prevent the salts from accumulating in the root zone, more irrigation water must be applied to flush the dissolved salts downward past the root zone. A shallow water table or clayey soils can inhibit this downward flushing of salts. To prevent this, subsurface tile drains are installed, consisting of parallel lines of drain tiles that are typically installed about six feet below the ground surface.

Water Conservation Measures

The IID has pursued water conservation programs aimed at reducing water consumption. Because inflows to the Salton Sea are primarily the result of wastewater generated by various sources, these conservation measures can decrease inflows to the Salton Sea.

IID has entered into an agreement with the MWD to implement water conservation programs that could result in conserving 106,110 AFY of water. In return for funding the conservation programs, MWD would be allowed to divert an amount of water equivalent to the water saved by IID at its diversion to the Colorado River Aqueduct at Lake Havasu in Arizona.

Among the other water conservation programs that IID is studying are reusing drain water on idle lands, constructing storm detention basins on the East and West mesas, alternating irrigation with drain water and canal water, using drain water to maintain wetlands, and separating tailwater from tile drain flows to enable the reuse of the tailwater (Imperial County 1997).

3.1.6 Surface Water Conditions in the Colorado River Delta

Figure 3.1-5 shows the historic annual volumes of flows into Mexico since 1894 (IBWC 1999). The historical changes in Colorado River flows are due to human activities superimposed on natural variations in runoff from watersheds in the U.S. Flows in the Colorado River began to be regulated by filling of Boulder Dam in 1933. Until then, flows of more than 15 MAFY were not uncommon. Since 1944, the minimum amount of water delivered to Mexico has been set by international treaty at 1.5 MAFY, with an additional 0.2 MAFY provided in wet years.

The term "flood flows," as used in this report, refers to the quantity of water that is delivered to Mexico above the amount that the U.S. is obligated to deliver under the 1944 Treaty. Flood flows represent excess water that is released from, or passed through the storage and conveyance system in the U.S. in order to maintain adequate flood storage space, based on the capacities and operating rules of the various facilities in the system (Bureau of Reclamation 2000). This water represents water above the amount that can be used by water users in the U.S. There are currently no requirements to provide any water for environmental purposes in Mexico.

Figure 3.1-6 shows how much of the total water delivered to Mexico since 1950 has been diverted to irrigation canals at Morelos Dam, and how much has been released to the Colorado River below Morelos Dam (IBWC 1999). As can be seen in the figure, relatively little of the water in excess of the 1.5 to 1.7 MAFY treaty allocation is diverted for irrigation. Diversions to irrigation canals below Morelos Dam exceeded 1.7 MAFY in only 14 of the 24 years since 1950 in which deliveries to Mexico were greater than 1.7 MAFY. In those 14 years, an average of about 523,000 AFY was diverted to irrigation canals. By contrast, an average of 5.1 MAFY of flood flows were available during those 14 years. Therefore, on average, about 10 percent of the flood flows were diverted for irrigation in those 14 years. The remainder of the flood flows were released to the Colorado River below Morelos Dam.

From about 1964 until 1978 Mexico received only the amount of water allotted by treaty because Lake Powell was being filled during this period. A brief period of wet years occurred from 1979 through 1981, and some flood flows were released to Mexico. Then, a series of very wet years occurred between 1983 and 1987. The average annual flood flow during this five year period was nearly 10 MAFY.

Figure 3.1-5 Total Annual Water Deliveries to Mexico (1894-1998)

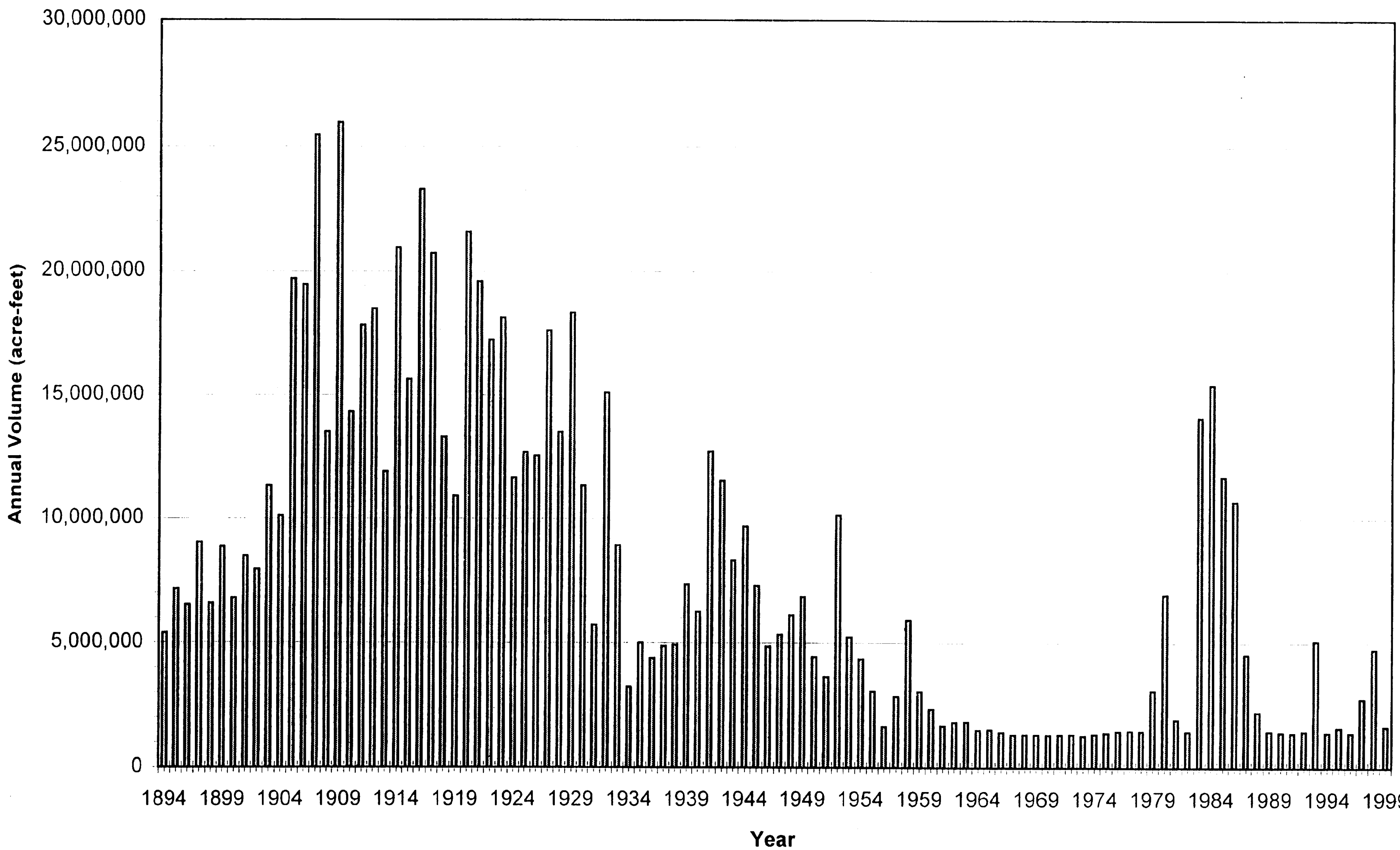
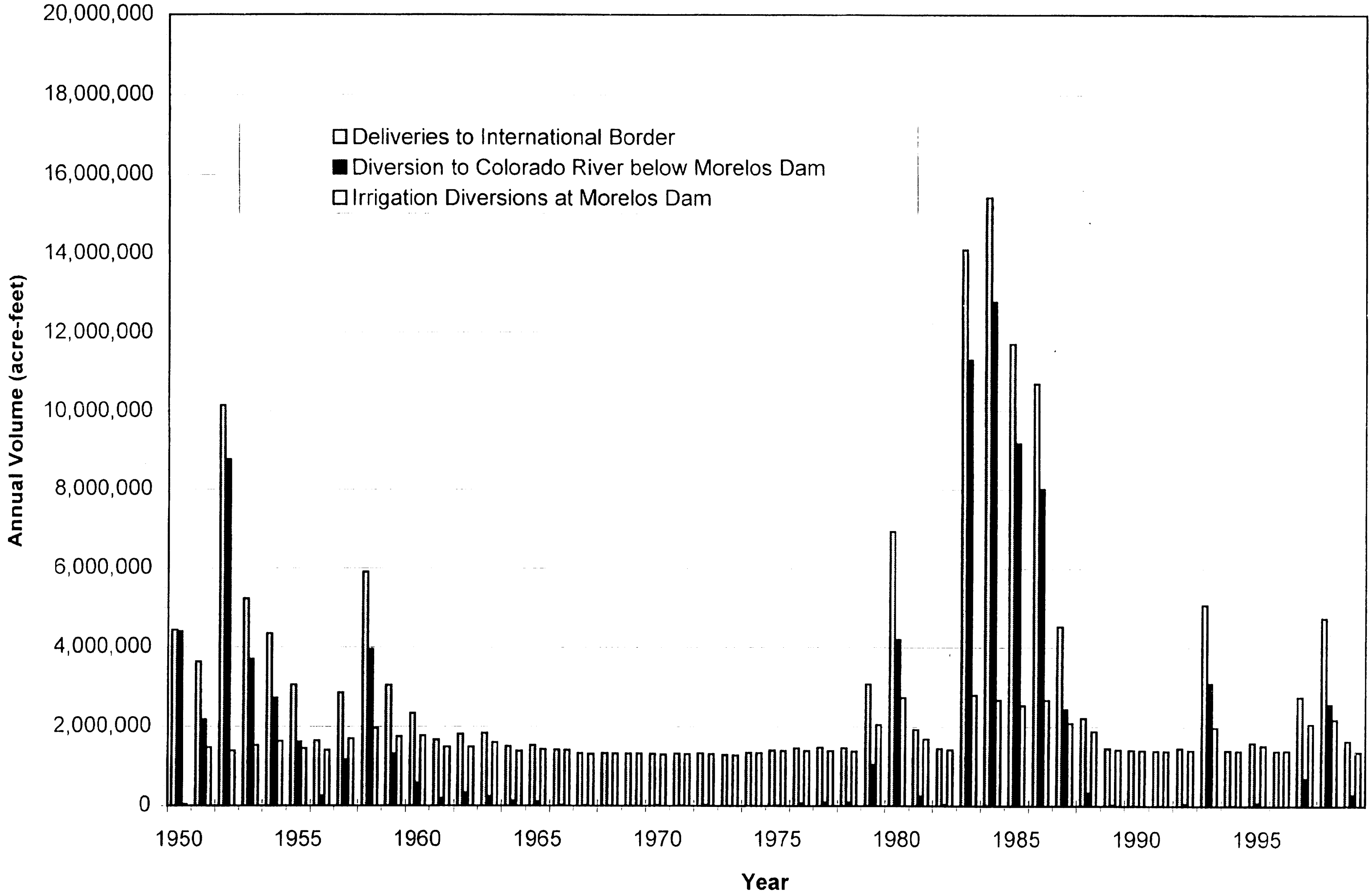


Figure 3.1-6 Total Annual Water Deliveries to Mexico and Releases to Colorado River (1950-1999)



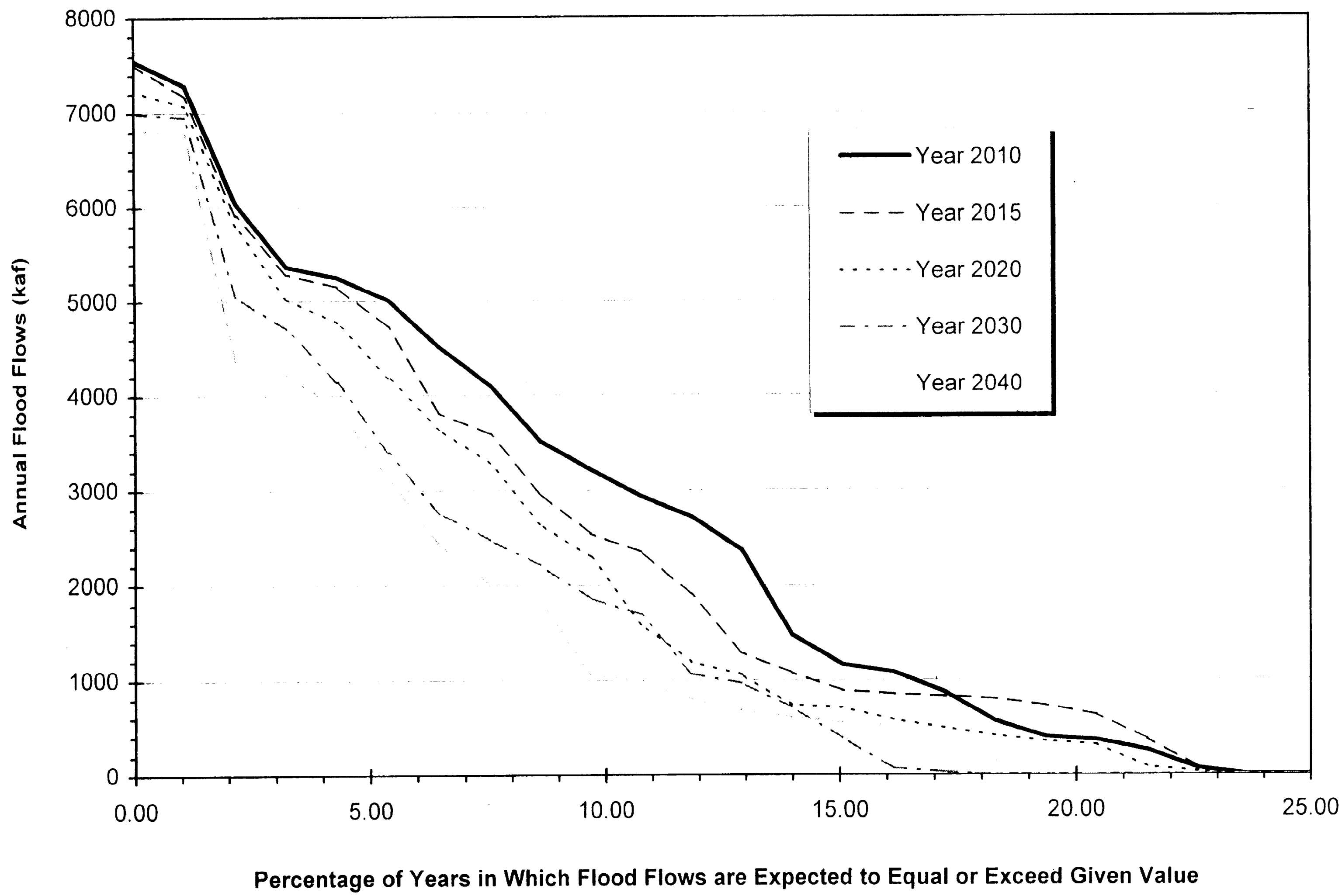
Prior to 1983, a natural dam in the channel of the Colorado River, about 22 miles from the mouth of the river, caused water to back up into the flood plain of the Rio Hardy, creating a large fresh/brackish water wetland. The Rio Hardy is a branch of the Colorado River that flows along the west side of the Delta. During the time that Lake Powell was being filled, almost no water flowed in the main channel of the Colorado River. The source of flows into the Rio Hardy wetland was primarily geothermal well discharge and irrigation return flows. In 1973, the Rio Hardy wetland covered about 45,000 acres (Glenn et al 1996). In 1979 and 1980, flood flows were again released into the Colorado River. Then, in 1983 flood flows exceeded 12 MAFY. These flows caused damage to flood control structures and irrigation facilities. The high water breached the natural dam in the channel of the Colorado River that had been responsible for the Rio Hardy wetlands. In 1983, theRio Hardy wetlands covered nearly 150,000 acres.

Following the flooding of 1983-1986 the banks of the main channel of Colorado River were built up as a flood control measure, to promote drainage and prevent the river from overflowing into irrigated fields. This, and the loss of the natural dam, had the effect of reducing flows into the Rio Hardy wetlands. In addition, a canal was constructed to allow water in the Rio Hardy wetlands to drain to the Laguna Salada for evaporation. By 1986 the Rio Hardy wetlands had been reduced to about 94,000 acres, and by 1988, the area of wetlands was reduced to only about 3,200 acres (Glenn et al 1996). As can be seen by comparing to the graph in Figure 3.1-6, the reduction in acreage of the Rio Hardy wetland occurred very rapidly in conjunction with reduced flood flows. Furthermore, flood flows resumed in 1993, and with them, the Rio Hardy wetlands expanded to about 24,000 acres (Glenn et al 1996).

Figure 3.1-7 shows the expected change in the availability of flood flows delivered to Mexico over the next 40 years expressed in terms of probability distributions. The probability distributions describe the liklihood that flows of a certain size will occur, based on current information about historical flows and assumptions about future water use (Bureau of Reclamation 2000). It is necessary to describe these future conditions in terms of probabilities, because flood flows depend on precipitation and runoff in the Colorado River and Gila River watersheds, and these conditions vary widely and unpredictably from year to year. In addition, the quantity of flood flows depend on the demand for water, and on decisions and strategies governing the storage and distribution of water. These strategies may change in response to hydrologic, demographic, and soci-economic factors. A more detailed discussion of the derivation of these probability functions, and the assumptions underlying hydrologic modeling, is presented in the Salton Sea Restoration Program Appraisal Report (Bureau of Reclamation 2000).

The vertical axis of the graph on Figure 3.1-7 shows the annual volume of flood flows, in thousands of acre-feet per year. The horizontal axis shows the percentage probability, in each year, that a given volume of flood flows will occur or be

Figure 3.1-7 Probability Distributions of Future Colorado River Flood Flows Delivered to Mexico



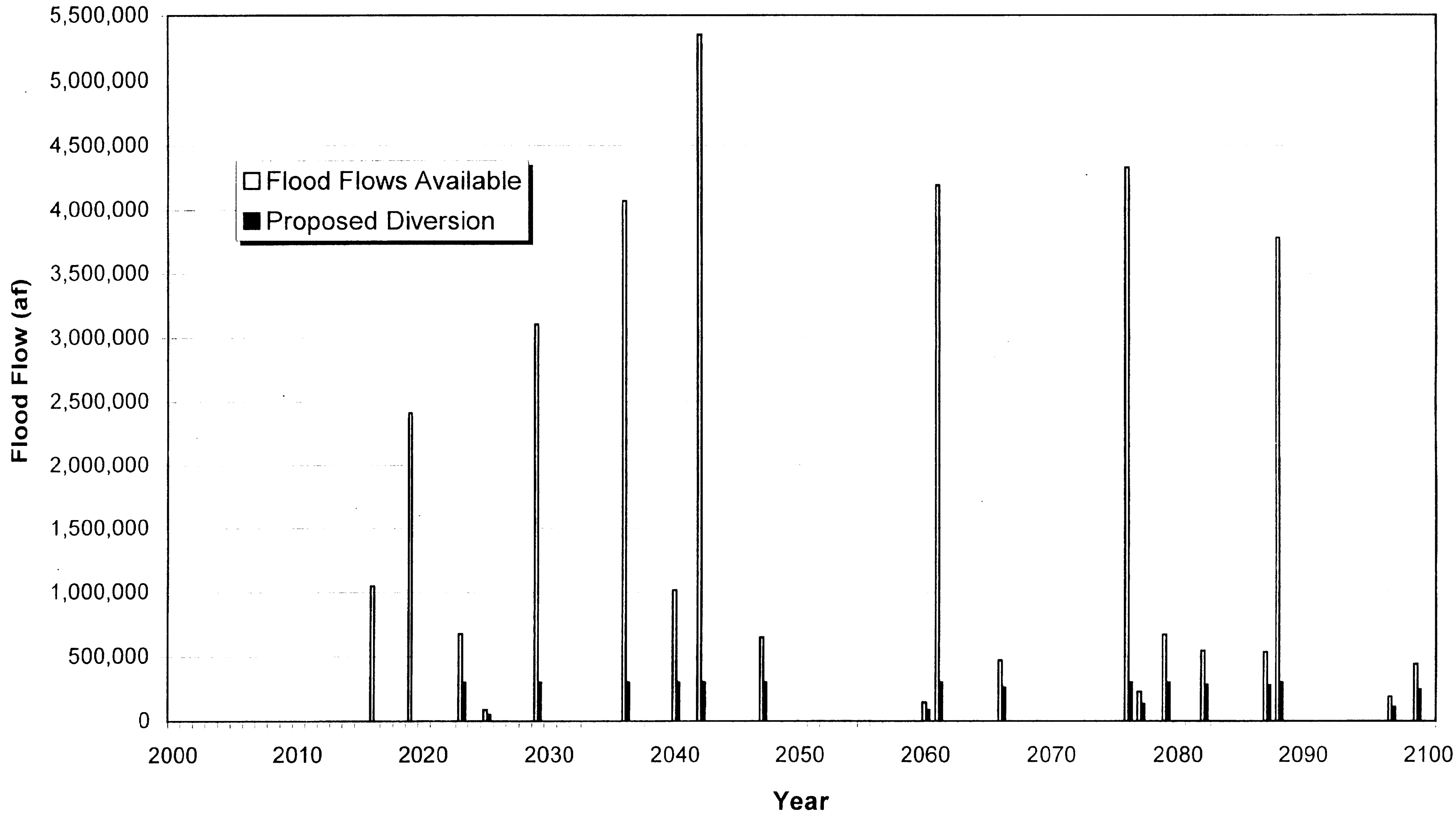
exceeded. Under the conditions expected to exist in 2010, Figure 3.1-7 indicates that the probability that flood flows will occur in any one year is about 23 percent. Stated a little differently, there is a 77 percent chance that flood flows would not occur at all (i.e., that flood flows would be less than zero).

Figure 3.1-7 also shows that larger flood flows have a lower probability of occurring. For example, there is a little more than a ten percent chance, under 2010 conditions, that flood flows would exceed 3 million acre-feet in a year. In general, the lines on the graph representing conditions further ahead in the future tend to be shifted to the left, toward lower probability. This is because use of Colorado River flows in the United States is expected to increase in the future. This additional water use will reduce the amount of flood flows. Thus, by 2040, it is expected that flood flows of 3 million acre-feet will have a little more than five percent chance of occurring in any given year.

Figure 3.1-8 shows an example of possible future flood flows based on the predictions of the Salton Sea Accounting Model. To arrive at the distribution of flows shown in Figure 3.1-8, the model randomly selected flood flows for each year. The size of the flood flows were based on the probability functions shown in Figure 3.1-7. The sequence of flood flows shown in Figure 3.1-8 is just one possible outcome, but it illustrates some important features of a randomly distributed pattern of flood flows that must be considered when evaluating the downstream impacts. For example, Figure 3.1-8 shows that there may be no flood flows available for long periods of time, and that flood flows may be clustered together. Figure 3.1-8 shows that it is not unusual to experience 5- to 15-year periods with negligible or no flood flows. Figure 3.1-8 also illustrates that flood flows range widely in magnitude.

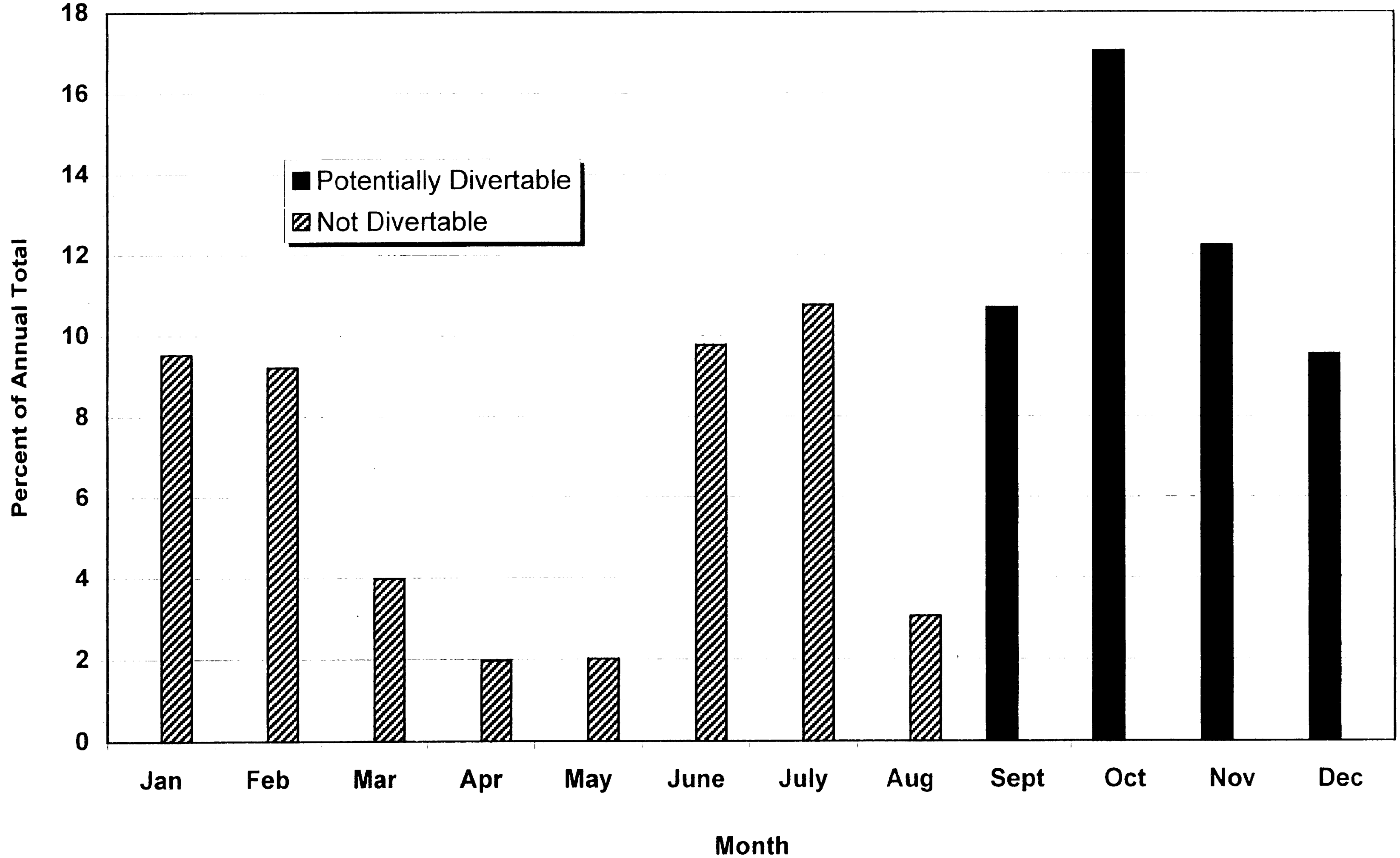
Figure 3.1-9 illustrates the expected distribution of flows during an average year. The variation in the distribution of the flows throughout the year results from factors such as the timing of runoff and the capacities of storage and conveyance facilities. The capacities of storage and conveyance facilities are based on factors such as the demand for water, hydrologic forecasts, return flows from irrigation, and the operating rules of storage and conveyance facilities. The months of September through December are shown as having flood flows that are potentially divertable into the Salton Sea. This corresponds to months when carriage capacity might be available to transport flood flows to the Salton Sea through the All American and Coachella Canals.

Figure 3.1-8 Sample Stochastic Trace of Future Colorado River Flood Flows Delivered to Mexico[1] and Portion that would be Diverted to the Salton Sea



[1] Total Available Flood Flows Beyond Requirement to Mexico

Figure 3.1-9 Average Monthly Divertable and Non-Divertable Flood Flows as Percentage of Total Flood Flows



3.2 GROUND WATER RESOURCES

3.2.1 Introduction

The affected environment discussion for ground water resources includes ground water hydrology, ground water quality, and ground water use and management. The Phase I study area is confined primarily to the Salton Basin, which is the region draining directly into the Salton Sea. The Salton Basin lies within a larger structural and topographical geologic feature known as the Salton Trough. Figure 3.2-1 shows the ground water basin divisions within the Salton Trough, as defined by the CRB-RWQCB (1994). The Salton Basin is divided into the following planning areas, which are important to the present analysis: the Coachella Valley Planning Area, the Imperial Valley Planning Area, the Anza-Borrego Planning Area, the East Mesa, and the Andrade Mesa in Mexico.

3.2.2 Ground Water Hydrology

In the Salton Basin, thick sequences of silt and clay have been deposited on the bottom of Lake Cahuilla and smaller lakes, alternating over time with coarser sands and gravels from periods when the lakes had dried out. Some of the sediments would have been brought into the basin in the sediment load of the Colorado River. These sediments contribute to the fertility of the soils in the Imperial and Coachella valleys. Then, as now, the lake sediments would have contained organic materials from the plants and animals that lived in the lake. As the lake dried, it left a residue of salts in the lakebed sediments. One of the results of this depositional sequence is that it has created hydraulically separated, confined aquifer units, bounded above and below by clay layers. The clay units tend to be thicker or more prevalent toward the center of the basin than at the edges, corresponding to the areas that have been inundated more frequently during past geologic time. Therefore, ground water is more likely to travel to greater depths on the margins of the basin, and most of the inflow to deeper aquifers probably occurs at the basin margins. Furthermore, since inflow to the basin is concentrated within washes and stream channels, most of the recharge to basin aquifers is likely to occur in the upper reaches of the washes and stream channels.

In the Coachella Valley Planning Area artesian ground water is confined below clay lakebed deposits that extend from the Salton Sea to about as far as Indio. The confined water is generally of good quality and is used for domestic supplies. Unconfined ground water, which is perched on the clay layers, is recharged primarily by irrigation. Faults, particularly the Mission Creek, Banning, and San Andreas faults, but also the Indio Hills, Garnet Hills, and Mecca faults, act as barriers to ground water flow. Ground water tends to pond behind the faults, creating springs and oases in some areas (CRB-RWQCB 1994).

Ground water is not widely used in the Imperial Valley Planning Area due to its high dissolved solids content. The shallow deposits are generally fine-grained in the northern portion of the valley and coarser in the south. Subsurface drains are required to prevent waterlogging of shallow soils under irrigation. The ground water is generally of poor quality and is not used for agriculture. In the central part of the valley, the TDS in most wells is between 1,000 and 3,000 mg/L. Water with TDS above 1,000 mg/L is considered to be of poor quality. There are a few domestic wells at higher elevations in the valley, where salts are lower in concentration (CRB-RWQCB 1994). The alluvial fill sediments extend to great depths in the Imperial Valley, but much of the water is saline and heated. It has been estimated that about 20 percent of the 1.1 to 3.0 billion acre-feet of ground water in storage throughout the Imperial Valley is recoverable (Imperial County 1997). Annual recharge from all sources is estimated to be about 400,000 acre-feet.

In the Anza-Borrego Planning Area, ground water is pumped mainly from unconsolidated sedimentary aquifers, although some wells are completed in fractured bedrock. The natural flow of ground water has been affected by pumping. The safe yield of the aquifer is estimated to be about 22,000 AFY (CRB-RWQCB 1994).

The southeastern portion of the Salton Basin, including the East Mesa in the US and the Andrade Mesa in Mexico, is underlain by thick alluvial and dune sand deposits. The southeastern portion of this Mesa region overlies the Colorado River Aquifer, which extends eastward under the Yuma area and westward at least as far as Drop 3 on the All American Canal (Bureau of Reclamation 1994). Yields from wells in this area are moderate to high. The western part of the Mesa area lies within the Salton Basin, and part of it lies within the ancient shoreline of Lake Cahuilla. The hydraulic conductivity of the deposits decreases toward the west, due to the increased clay content of the sediments, and the yields in wells are also lower. About 10 percent of the recharge to the Colorado River Delta aquifer is from seepage from the All American Canal (Bureau of Reclamation 1994). This seepage forms a ground water ridge beneath the canal, with most of the seepage flowing toward the south. Presumably, the direction of this ground water flow is due primarily to the relatively higher permeability of sediments toward the south.

Ground Water Inflow to the Salton Sea

Ground water inflow to the Salton Sea has been estimated at 50,000 acre-feet, about 30,000 acre-feet (about 60 percent) of which is contributed by the Coachella Valley. About 10,000 acre-feet (20 percent) of the ground water inflow is underflow from San Felipe Creek. Only about 2,000 acre-feet (four percent) of the ground water inflow comes from the Imperial Valley. About 8,000 acre-feet (16 percent) of the ground water inflow is from the remaining sources, most which are on the east side of the Salton Sea (USDI 1970). Among these sources is leakage from unlined portions of the Coachella Canal.

The relatively small amount of ground water inflow from the Imperial Valley is due to low vertical permeability of soils and lack of recharge at the basin margins. Imperial Formation soils, which are found on the flatter slopes in the northern portion of Imperial Valley, are silty clays. These soils derive from ancient lakebed deposits and alluvium deposited when the basin was inundated by flooding from the Colorado River. Soils contain less clay and more sand toward the margins of the basin.

Tritium isotope concentrations can be used to determine the source and age of water. Tritium is an isotope of hydrogen that was released into the atmosphere by atomic weapons tests during the 1950s. Tritium is in the water imported from the Colorado River but is essentially absent from ground water at depths greater than about 65 feet throughout the Imperial Valley (Setmire et al. 1993). The lack of tritium in ground water below 65 feet is an indication that this water has been isolated from surface sources since at least the 1950s and suggests that there is very little deep recharge from irrigation water.

3.2.3 Ground Water Quality

The quality of ground water inflow to the Salton Sea varies significantly by source. The average concentration of TDS was estimated by the US Department of Interior (USDI 1970) for the principal inflow sources. Inflow from the Coachella Valley was estimated to contain about 800 mg/L, inflow from the San Felipe Valley contained 1,200 mg/L, and inflow from the Imperial Valley was estimated to contain 1,600 mg/L. Combined inflow from all other sources, primarily on the east side of the Salton Sea, was estimated to average 3,000 mg/L. Based on these concentrations multiplied by the volume of inflow, the total salt loading to the Salton Sea from all ground water inflow sources was estimated to be 86,500 tons per year. The average ground water salinity in all ground water inflow sources combined is about 1,300 mg/L.

3.2.4 Ground Water Use

Very little ground water is extracted from Imperial Valley, due to its relatively poor quality. The CRB-RWQCB reported that there are four domestic wells drilled to a depth of about 600 feet in the East Mesa Unit of the Imperial Irrigation District. Ground water is more extensively used in the Coachella Valley, where it accounts for most of the municipal water supplies.

3.3 Geology and Soils

3.3.1 Introduction

The affected environment discussion for geology and soils includes the geologic setting, soils and sediments, and geologic hazards. Geologic resources include topography, stratigraphy, soils and sediments, mineral resources, and landforms within the region and underlying the area of the proposed project. The geologic processes active in the region, such as erosion, slope stability, sedimentation, wind deposition, and seismicity, provide a pattern for the past influences on the project area and for likely future influences. Geologic hazards that could result from these processes include fault rupture, ground shaking, unstable slopes, and the potential for liquefaction, differential settlement, and lateral spreading. The Phase I study area for geology and soils is determined by the anticipated extent of direct and indirect disturbance to these resources and the anticipated area that could be affected by regional geologic hazard conditions. The affected environment section describes the existing conditions of geologic resources and processes within this area from which to compare potential effects of project-related actions.

3.3.2 Geologic Setting

The Salton Sea is in the northern portion of the Salton Trough, a seismically active rift valley extending northwestward from the Gulf of California into southern California. Most direct project-related influences are expected to occur within this region. The Salton Trough is approximately 130 miles long and 70 miles wide and is bounded by the San Gorgonio Pass to the northwest, the San Jacinto and Santa Rosa mountains on the west, and the Little San Bernadino and Chocolate mountains on the east. This structural basin encompasses the Coachella Valley in the north and the Imperial Valley, the Mexicali Valley, and the Gulf of California in Mexico in the south.

The Salton Trough is filled with approximately 21,000 feet of Cenozoic sediments derived predominantly from the Colorado River, which emptied into the Gulf of California, forming a delta that spread and eventually separated the Salton Basin from the Gulf of California. The resultant basin topography is relatively flat, with little topographic relief, and is characterized by internal drainage (Bureau of Land Management, California Desert District and County of Imperial Planning and Building Department 1995). Windblown sand deposits form a 40-mile long by five- mile wide belt of sand dunes, called the Sand Hills, extending from the Mexican border along the east side of the Coachella Canal (US Geological Survey et al. 1966). An old lake shoreline has been identified by the presence of lacustrine deposits in areas within the Coachella and Imperial valleys. It is estimated that Lake Cahuilla covered an area approximately 117 miles long and 30 miles wide (US Department of the Interior and the State of California 1974). The sequence of sedimentary layers is underlain by the Imperial Formation, which is of marine origin and is underlain by igneous and metamorphic basement rocks (US Geological Survey et al. 1966).

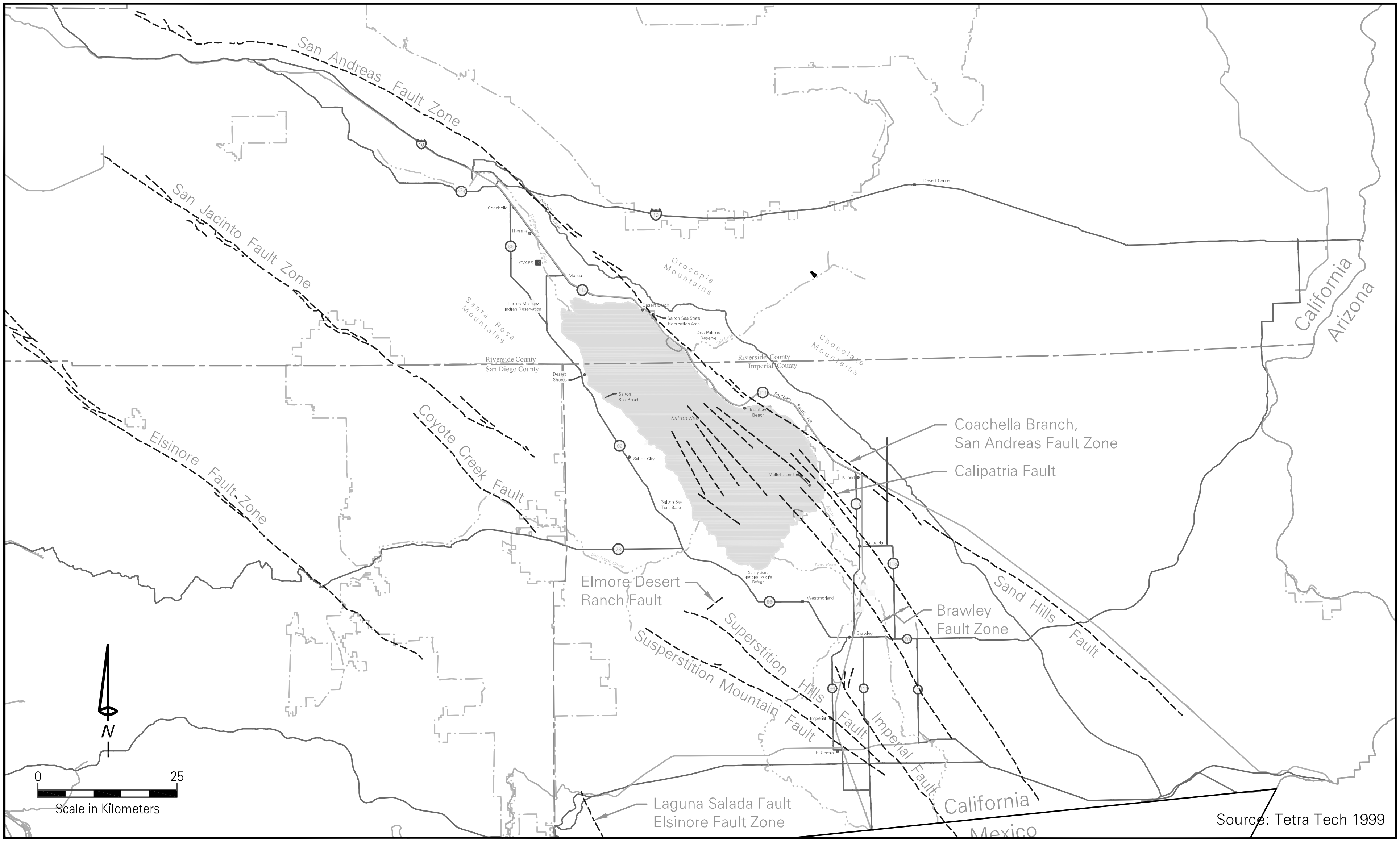
The Salton Trough is the northern extension of the Gulf of California Rift Zone and is characterized by northwest-southeast trending transform fault zones and several crustal rift areas between these fault zones. This region has undergone subsidence, uplift, tilting, folding, and crustal spreading over many millions of years and is considered one of the most active seismic areas in the world. The area regularly experiences perceptible earthquakes, both large-scale seismic events and low magnitude earthquake swarms (US Department of the Interior and the State of California 1974; Bureau of Land Management, California Desert District and County of Imperial Planning and Building Department 1995; ERC Environmental and Energy Services Co. 1989).

Numerous major and several less extensive active fault zones are within the Salton Trough. These zones contain a number of individual fault traces. Figure 3.3-1 and Table 3.3-1 describes the active and potentially active major faults within this region. An active fault is one that has experienced surface displacement within the last 11,000 years; a potentially active fault shows evidence of displacement within the last 1.6 million years (CDMG 1992). The southern portion of the Salton Sea has a much greater rate of seismicity than does the northern area (US Department of Interior, Bureau of Reclamation 1999).

The major fault zones in the area, which are characterized by right lateral movement, are the San Andreas, San Jacinto, and Elsinore fault zones. The Brawley fault and associated zone of seismicity includes much of the southeastern portion of the Salton Sea. This zone has been a persistent region of seismic activity since at least 1900 and surface rupture occurred along several miles of the fault zone during the 1979 Imperial Valley earthquake (US Department of Interior, Bureau of Reclamation 1999). The Elmore Ranch fault is a relatively short structure that experienced minor surface rupture associated with the 1987 Superstition Hills-Elmore Ranch earthquake sequence. Although the mapped length is only about 5 miles, the fault appears to be the western end of a zone of seismicity termed the Elmore Ranch Seismic Zone that extends several miles across nearly the entire southern end of the Salton Sea. This zone could also be a site for potential surface fault rupture for any facilities built across it in the southern Salton Sea (US Department of Interior, Bureau of Reclamation 1999). In addition, other inferred faults have been identified beneath the southern portion of the Salton Sea (US Department of the Interior and the State of California 1974).

3.3.3 Soils and Sediments

Soils. Soil associations in the Salton Trough can be grouped into two major categories: soils of the basin and soils of the mesas, alluvial fans, terraces, and mountains rimming the basin. The distribution of soil associations within the Salton Basin is shown on Figure 3.3-2. In general basin soils vary from excessively drained to poorly drained sand, silt, clay, and loam on nearly level to rolling topography (US Department of Agriculture Soil Conservation Service 1981). Soils on alluvial fans, valley fill, and lacustrine basins in the Coachella Valley are very deep, highly stratified sands to silty clays formed in alluvium and are used for irrigated truck and field crops (US Department of Agriculture Soil Conservation Service 1979). Lacustrine basin soils in the Imperial Valley formed in the area of Lake Cahuilla and are very deep, moderately well drained to well drained, except those adjacent to the Salton Sea, where they are poorly drained. There is a perched water table in these soils in most areas, due to the poorly drained nature of the soils coupled with seepage from canals and irrigation. These soils are used mainly for irrigated cropland (US Department of Agriculture Soil Conservation Service 1981).



Legend

------ Fault Traces

Fault Map

Salton Sea, California

Figure 3.3-1

Table 3.3-1
Salton Basin Fault Characteristics

Fault	Maximum Credible Earthquake	Estimated Peak Ground Acceleration	Estimated Repeatable High Ground Acceleration	Estimated Maximum Mercalli Scale Intensity
Active Faults				
San Andreas	7.5	0.275	0.180	VIII
Brawley	7.0	0.290	0.190	VIII
Imperial	7.2	0.275	0.180	VIII
Superstition Hills (Elmore Desert Ranch)	7.0	0.60	0.40	IX
San Jacinto (Coyote Creek)	7.2	0.310	0.20	VIII
Elsinore	7.5	0.210	0.210	VIII
Potentially Active Faults				
Calipatria	7.5	0.290	0.190	VIII
Sand Hills	7.5	0.150	0.150	VII
Superstition Mountain	7.0	0.360	0.234	VIII-IX
Laguna Salada	7.25	0.175	0.175	VII-VIII

Source: ERC 1989.

Sediment Types. Data characterizing the sediment types and current contaminant concentrations of the Salton Sea are extremely limited, and additional studies are in progress. Previous studies identified concentrations of organochlorine pesticide residues, including DDT and DDE, and some of the metals and chemicals known to be present in riverbeds feeding the Sea, such as selenium, boron, DDE, DDT, dichloromethane, PCBs, and pesticides (Bechtel 1997; Eccles 1979; Hogg 1963; and Setmire et.al. 1993; Setmire & Stroud 1990). Some of the highest concentrations of DDT metabolites were found in bottom sediments at the outlets of the Alamo River, the New River, and Trifolium Drain 1 (Levine-Fricke 1999; Setmire et al. 1993). No evidence of residual chlorine compounds (which are common degradation products of DDE, DDT and PCBs) was presented in the most recent data collected by Levine-Fricke during the December 1998 and January 1999 sediment sampling study. Similarly, during 1999 field work, 67 semi-volatile compounds and 27 pesticides were sampled for in the water column within the Sea and all were found to be below detection limits (Holdren, personal communication 1999). The reader is referred to the Water Quality section of this document discussed within the Surface Water Resources section for more details on this study. An investigation of selenium toxicity derived from irrigation drainage was conducted to identify the potential for harmful effects on the Salton Sea ecosystem. A relatively high selenium concentration of 3.3 mg/kg was detected in one composite sediment sample from the Salton Sea, and the lowest concentration of 0.1 mg/kg was detected in sediments at the Whitewater River upstream of Highway 111 (Setmire et al. 1990).

Data collected by Levine-Fricke during December 1998 and January 1999 for an ongoing sediment sampling study provide the most current information on the distribution of inorganic and organic chemicals and grain sizes in Salton Sea sediments. The inorganic and organic chemicals of concern were identified using available comparative values (e.g., maximum "baseline value" for soils of the western United States (Severson et al., 1987; modified from Shacklette and Boerngen, 1984.) The National Oceanic and Atmospheric Administration (NOAA) biological effects range low (ERL) and effects range medium (ERM) values (Long et al., 1995) were also used as comparative values during the first phase of sampling to identify which contaminants should be the focus of additional sampling efforts in either second phase sampling or follow-up work. The ERL and ERM values are guidelines used to evaluate whether sediment chemical concentrations were within ranges that have been reported to be associated with biological effects. These guidelines were generated from a large national sediment database and are currently the most widely used and accepted sediment effects guidelines available. ERMs are the concentrations at which 50 percent of the studies for a particular chemical showed biological effects, and ERLs are the concentrations at which 10 percent of the studies showed biological effects.

Selenium and molybdenum do not currently have ERM or ERL values for comparison. Therefore for selenium, SFRWQCB guidelines for sediment suitable for cover (0.7mg/kg) and noncover (1.4 mg/kg) sediment in wetlands creation projects were used for comparison purposes. For molybdenum, a baseline value of 4.0 mg/kg (Severson et al., 1987; modified from Shacklette and Boerngen, 1984) was used as a comparative value.

This study identified levels of cadmium, copper, lead, nickel, and zinc in Salton Sea sediments that exceeded their respective ERL values but none were detected at concentrations above their respective ERM values. The highest cadmium concentrations were in the northeastern quadrant of the Sea, while high nickel concentrations were identified throughout most of the Sea sediments, except in areas of surface inflows, such as the Alamo River and New River delta areas. High zinc concentrations were localized near the northern shore, where the Whitewater River enters the Sea, and near the eastern shore, where Salt Creek enters the Sea. Selenium and molybdenum exceeded their screening values and in the Levine-Fricke study appeared to be elevated with respect to previously reported background concentrations and Salton Sea data. Confirming previous observations, the highest selenium levels were found in the central and north-central two thirds, and the lowest levels were in the southern third of the Sea. Since several past studies have reported differing results, further study should be done to confirm results of the latest Levine-Fricke work.

Selenium, which is one of the primary elements of concern in the Salton Sea, is found at its highest concentrations in water in the areas of tile-drain effluent. However, the greatest concentrations in sediments have been found predominantly in the central portion of the Sea, where concentrations in water were relatively low (Setmire et al. 1990; Levine-Fricke 1999). Since selenium is thought to be entering the Sea from agricultural drainage, some mechanism in the Whitewater River Delta is thought to be removing selenium from the water and concentrating it in bottom sediments. Certain processes could concentrate selenium in bottom sediments that are distant from the waters from which the selenium was derived. These processes are incorporation of selenium in phytoplankton, which settle in the anoxic zone; oxidation and reduction processes, which can transform selenium compounds to insoluble forms; and removal and concentration due to the activity of microorganisms. Other elements, such as nickel, chromium, and zinc, which have been detected in elevated concentrations in the bottom sediment of the Whitewater River, are thought to be the result of industrial contamination rather than agricultural effluent (Setmire et al. 1990).

The potential for the observed contaminant concentrations to adversely affect benthic organisms can be assessed preliminarily by comparison with available sediment guidelines (ERLs and ERMs) however, as a result of the Sea's unique ecosystem, whose characteristics (especially high salinity) put it well outside the database used to develop the ERLs and ERMs, these comparative values may not be applicable for evaluating ecological risks at the Sea. The biota of the Salton Sea's high salinity waters also differ from the organisms found in estuarine areas for which the ERLs and ERMs were developed.

A cursory comparison of historic data with those obtained during the Levine-Fricke study show a broad decrease in maximum levels detected in sediment concentrations for many of the inorganic and organic chemicals, particularly pesticides, copper, and zinc. One of the most significant findings from the Levine-Fricke study was that semivolatile organic compounds, chlorinated pesticides, polychlorinated biphenyls (PCBs), organophosphate and nitrogen pesticides, and chlorinated herbicides were not detected in the sediment samples analyzed.

The most comprehensive study on the distribution and composition of Salton Sea sediments was conducted in 1961. This study describes the pH and the distribution of organic material, heavy minerals, and grain size throughout the sediments. In general, the pH of the sediments is lower than that of the overlying water, and grain size decreases inward toward the central portion of the Sea, with a few exceptions (Arnal 1961). The 1998 and 1999 Levine-Fricke data show sediments sampled on the bottom of the Sea consisted of silt, clay, and finer grained sands. The shallow sediment also included abundant barnacle shells and occasional fish bones (Levine-Fricke 1999). The surface sediment composition included a high percentage of sand outside Salton City and extending into the central, deeper parts of the Sea. San percentages near the mouths of the New and Alamo rivers were also high, as expected from deposition of these heavier particles from higher velocity inflows into the Sea. The lower velocity Whitewater River delta, on the other had, was predominantly silt. Silt was also abundant along the southwest near shore area and along the shallow water bays near the New and Alamo rivers. A shallow layer of clay blankets the southwestern corner of the Sea and extends toward the center, near the deepest part of the Sea. Clay is also abundant near shore and offshore just north of Desert Shores. The majority of the deeper sediment sampled consisted predominantly of varied amounts of silt and clay, with lesser amounts of fine sand (Levine-Fricke1999). A sedimentation rate of 0.02 to

0.03 inches per year in the 50 years after the 1905 flood was estimated for the central portion of the Sea, and a rate of two inches per year was estimated at the Alamo River and New River deltas (Arnal 1961). A layer of organic material overlies these sediments, deposited most heavily in areas where currents are weakest (Arnal 1961).

Economic Resources. Resources in the region consist of numerous known geothermal areas and such mineral resources as rock and stone, sand, gravel, clay, and gypsum, and such metals as gold, silver, nickel, and lead, and several radioactive elements. In general, geothermal resource areas and sources of sand and gravel are found in the basin area, and other minerals are found in the surrounding hills. Within the Imperial Valley, there are six known geothermal resource areas (KGRAs), delineated by the USGS and covering approximately 254,827 acres (Layton 1978). These geothermal areas include the Salton Sea KGRA, Brawley KGRA, Heber KGRA, Glamis KGRA, East Mesa KGRA, and the Dunes KGRA. Sand and gravel has been a significant resource in both Imperial and Riverside counties. Most of this material in the Salton Basin is derived from shoreline deposits from ancient Lake Cahuilla. Other sources of lower quality can be found in alluvial fan deposits (Morton 1977; California Department of Conservation, Division of Mines and Geology 1988).

3.3.4 Geologic Hazards

Potential geologic hazards associated with the Salton Trough include seismic hazards, such as ground rupture, ground acceleration, liquefaction and dynamic settlement, seismically induced landsliding, and nonseismic hazards, such as differential compaction and settlement, expansion, erosion, and reactivity.

Ground rupture, which is the physical displacement of surface deposits due to seismic activity, could occur along both major and minor faults as a result of activity along the major fault zones in the area. Ground acceleration is measured in terms of peak ground motion associated with an earthquake and is expressed in terms of a percentage of gravitational acceleration (g). Large earthquakes along major faults, such as the Imperial Fault, could produce potentially destructive ground shaking in the Salton Trough. Ground acceleration as intense as 0.6 g near Westmorland has been projected for a magnitude 7.0 earthquake along one of the Superstition Hills faults (ERC Environmental and Energy Services Co. 1989, 1991; Bureau of Land Management, California Desert District, and County of Imperial Planning and Building Department 1995).

In California, special restrictions apply to construction within "fault-rupture hazard zones," as defined by the California Department of Mines and Geology (CDMG) under the Alquist-Priolo Special Studies Zones Act of 1972, Cal. Pub. Res. Code §2621, et seq. These restrictions are designed to prevent structures for human occupancy being built across the traces of active faults. A number of these zones have been identified throughout the Salton Trough and are shown on Figure 3.3-3.

Liquefaction and dynamic setting could occur in loose, sandy, fine-grained granular settlements that are saturated or nearly saturated at depths of less than 100 feet during a strong seismic event (ERC Environmental and Energy Services Co. 1989, 1991; Bureau of Land Management, California Desert District, and County of Imperial Planning and Building Department 1995).

Seiches are produced when seismic waves cause massive oscillatory motion in restricted water bodies, such as bays and lakes, such as the Salton Sea (Bureau of Land Management, California Desert District, and County of Imperial Planning and Building Department 1995).

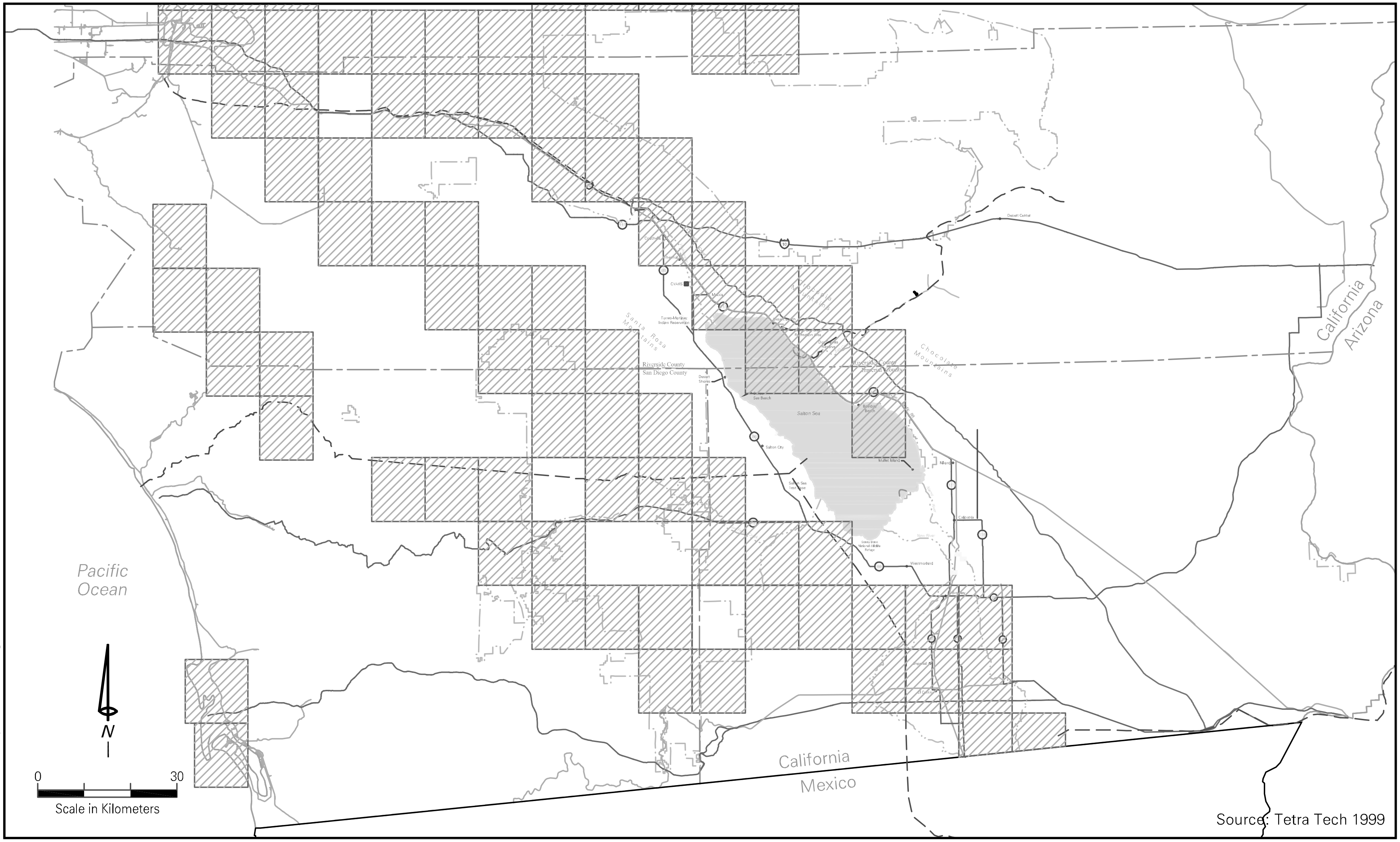
Nonseismic geologic hazards also can affect the integrity of structures that are built on areas exhibiting these characteristics. Differential compaction and settlement typically occur in loose, well-graded soils as a result of tectonic subsidence, saturation of dry unconsolidated sediments, withdrawal of fluids from porous soils, or collapse into subsurface voids. Sediments with high clay content may be subject to expansion. Erosion related to stormwater runoff and seasonal high winds in the area also could constrain construction. Alkaline soils, soils with soluble sulfates and chlorides, and soils that exhibit low resistivity can corrode subsurface facilities (ERC Environmental and Energy Services Co. 1989, 1991; Bureau of Land Management, California Desert District, and County of Imperial Planning and Building Department 1995).

3.4 AIR QUALITY

3.4.1 Introduction

The affected environment discussion for air quality addresses ambient air quality standards, existing ambient air quality conditions, air quality planning, and regulatory considerations. Air quality management programs have evolved using two distinct management approaches:

- Setting ambient air quality standards for acceptable exposure to air pollutants, conducting monitoring programs to identify locations experiencing air quality problems, and then developing programs and regulations designed to reduce or eliminate those problems; and
- Identifying specific chemical substances that are potentially hazardous to human health, and then regulating the amount of those substances that can be released by individual commercial or industrial facilities or by specific types of equipment.



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Proposed Pipeline Locations

Area Represented by USGS Quadratic Map with Identified Fault Rupture Hazard Zones

Fault Rupture Hazard Zones

Salton Sea, California

Figure 3.3-3

Air quality programs based on ambient air quality standards typically address air pollutants that are produced in large quantities by widespread types of emission sources and which are of public health concern because of their toxic properties. Air quality programs based on regulation of other hazardous substances typically address chemicals used or produced by limited categories of industrial facilities. Programs regulating hazardous air pollutants focus on: substances that alter or damage the genes and chromosomes in cells, creating the potential for cancer, birth defects, or other developmental abnormalities; substances with serious acute toxicity effects; and substances that undergo radioactive decay processes, resulting in the release of ionizing radiation.

The air quality study area for Phase 1 aspects of the project emphasizes conditions in the Salton Sea Air Basin, which encompasses the Coachella Valley portion of Riverside County and all of Imperial County. Most facilities for the project alternatives would be located in the Imperial County portion of the Salton Sea Air Basin. The Imperial County portion of the air basin is within the jurisdiction of the Imperial County Air Pollution Control District (Imperial County APCD). The Riverside County portion of the air basin falls within the regulatory jurisdiction of the South Coast Air Quality Management District (South Coast AQMD). The Torres-Martinez Tribe has the authority to assume jurisdiction over any facilities constructed on tribal lands.

Appendix C provides additional supporting information, including: a background discussion of terminology related to particulate matter; tabular and graphical summaries of ambient air quality monitoring data from the Salton Sea Air Basin; and tabular and graphical summaries of meteorological data from the Salton Sea Air Basin.

3.4.2 Ambient Air Quality Standards

Both the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA) have established ambient air quality standards for several different pollutants. The federal and state ambient air quality standards for the pollutants of greatest concern in the Salton Sea Air Basin are summarized in Table 3.4-1. Ambient standards for some air pollutants have been set for two or more exposure periods. EPA adopted a new 8-hour ozone standard and new fine particle ($PM_{2.5}$) standards in July 1997. These standards became effective in September 1997, and are included in Table 3.4-1. The new federal 8-hour ozone standard eventually will replace the federal 1-hour ozone standard. The federal 1-hour ozone standard will be rescinded for an area only after EPA determines that the 1-hour standard has been achieved in that area. The new particulate matter and ozone standards have been challenged in court. Air quality management programs related to these standards are on hold pending final resolution of the court challenges.

Table 3.4-1
Federal and State Ambient Air Quality Standards

			Standard, as parts per million		Standard, as micrograms per cubic meter		Violation Criteria	
Pollutant	**Symbol**	**Averaging Time**	**California**	**National**	**California**	**National**	**California**	**National**

Ozone	O_3	1 hour	0.09	0.12	177	235	If exceeded	If exceeded on more than 3 days in 3 years
		8 hours	---	0.08	---	157	---	If exceeded by the mean of annual 4th highest daily values for 3 years.
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
Inhalable particulate matter	PM_{10}	Annual Geometric Mean	---	---	30	---	If exceeded	---
		Annual Arithmetic Mean	---	---	---	50	---	If exceeded as a 3-year single station average
		24 hours	---	---	50	150	If exceeded	If exceeded by the mean of annual 99th percentile values over 3 years
Fine particulate matter	$PM_{2.5}$	Annual Arithmetic Mean	---	---	---	15	---	If exceeded as a 3-year spatial average of data from designated stations
		24 hours	---	---	---	65	---	If exceeded by the mean of annual 98th percentile values over 3 years

Source: California Air Resources Board 1991. State and National Ambient Air Quality Standards (ARB Fact Sheet 39). 40 CFR § 50, 53, and 58.

Notes: All standards except the national PM_{10} and $PM_{2.5}$ standards are based on measurements corrected to 25 degrees C and 1 atmosphere pressure.
The national PM_{10} and $PM_{2.5}$ standards are based on direct flow volume data without correction to standard temperature and pressure.
Decimal places shown for standards reflect the rounding precision used for evaluating compliance.
Except for the 3-hour sulfur dioxide standard, the national standards shown are the primary (health effects) standards.
The national 3-hour sulfur dioxide standard is a secondary (welfare effects) standards.
USEPA adopted new ozone and particulate matter standards on July 18, 1997; the new standards became effective on September 16, 1997.
The national 1-hour ozone standard will be rescinded for an area when USEPA determines that the standard has been achieved in that area.
Previous national PM_{10} standards (which had different violation criteria than the September 1997 standards) will remain in effect for existing PM_{10} nonattainment areas until USEPA takes actions required by Section 172(e) of the Clean Air Act or approves emission control programs for the relevant PM_{10} state implementation plan.
Violation criteria for all standards except the national annual standard for $PM_{2.5}$ are applied to data from individual monitoring sites.
Violation criteria for the national annual standard for $PM_{2.5}$ are applied to a spatial average of data from one or more community-oriented monitoring sites representative of exposures at neighborhood or larger spatial scales (40 CFR § 58).
The "10" in PM_{10} and the "2.5" in $PM_{2.5}$ are not particle size limits; these numbers identify the particle size class (aerodynamic equivalent diameters in microns) collected with 50% mass efficiency by certified sampling equipment. The maximum particle size collected by PM_{10} samplers is about 50 microns aerodynamic equivalent diameter; the maximum particle size collected by $PM_{2.5}$ samplers is about 6 microns aerodynamic equivalent diameter (40 CFR § 53).

Federal ambient air quality standards are based on evidence of acute and chronic toxicity effects. Most state ambient air quality standards are based primarily on health effects data, but can reflect other considerations, such as protection of crops, protection of materials, or avoidance of nuisance conditions (such as objectionable odors). Most state ambient air quality standards are more stringent than the comparable federal standards or address pollutants that are not covered by federal ambient air quality standards.

Air pollutants covered by federal and state ambient air quality standards can be categorized by the nature of their toxic effects as:

- Irritants (such as ozone, particulate matter, nitrogen dioxide, sulfur dioxide, sulfate particles, hydrogen sulfide, and vinyl chloride) that affect the respiratory system, eyes, mucous membranes, or the skin;

- Asphyxiants (such as carbon monoxide and nitric oxide) that displace oxygen or interfere with oxygen transfer in the circulatory system, affecting the cardiovascular and central nervous systems;
- Necrotic agents (such as ozone, nitrogen dioxide, and sulfur dioxide) that directly cause cell death; or
- Systemic poisons (such as lead particles) that affect a range of tissues, organs, and metabolic processes.

Ozone and particulate matter are the air pollutants of greatest concern in the Salton Sea Air Basin, with carbon monoxide being an additional pollutant of concern in the Calexico area. Ozone is a strong oxidizing agent that reacts with a wide range of materials and biological tissues. Ozone is a respiratory irritant that can cause acute and chronic effects on the respiratory system. Recognized effects include reduced pulmonary function, pulmonary inflammation, increased airway reactivity, aggravation of existing respiratory diseases (such as asthma, bronchitis, and emphysema), physical damage to lung tissue, decreased exercise performance, and increased susceptibility to respiratory infections (Horvath and McKee, 1994). In addition, ozone causes significant damage to leaf tissues of crops and natural vegetation. Ozone also damages many materials by acting as a chemical oxidizing agent. Because of its chemical activity, indoor ozone levels are usually much lower than outdoor levels.

Suspended particulate matter represents a diverse mixture of solid and liquid material having size, shape, and density characteristics that allow the material to remain suspended in the air for meaningful time periods. The physical and chemical composition of suspended particulate matter is highly variable, resulting in a wide range of public health concerns.

Many components of suspended particulate matter are respiratory irritants. Some components (such as crystaline or fibrous minerals) are primarily physical irritants. Other components are chemical irritants (such as sulfates, nitrates, and various organic chemicals). Suspended particulate matter also can contain compounds (such as heavy metals and various organic compounds) that are systemic toxins or necrotic agents. Suspended particulate matter or compounds adsorbed on the surface of particles can also be carcinogenic or mutagenic chemicals.

Public health concerns focus on the particle size ranges likely to reach the lower respiratory tract or the lungs. Inhalable particulate matter (PM_{10}) represents particle size categories that are likely to reach either the lower respiratory tract or the lungs after being inhaled. Fine particulate matter ($PM_{2.5}$) represents particle size categories likely to penetrate to the lungs after being inhaled.

In addition to public health impacts, suspended particulate matter causes a variety of material damage and nuisance effects: abrasion; corrosion, pitting, and other chemical reactions on material surfaces; soiling; and transportation hazards due to visibility impairment.

Carbon monoxide is a public health concern because it combines readily with hemoglobin in the blood, and thus reduces the amount of oxygen transported to body tissues. Relatively low concentrations of carbon monoxide can significantly affect the amount of oxygen in the blood stream since carbon monoxide binds to hemoglobin 200-250 times more strongly than oxygen. Both the cardiovascular system and the central nervous system can be affected when 2.5-4.0 percent of the hemoglobin in the blood is bound to carbon monoxide rather than to oxygen (Goldsmith, 1986; Gutierez, 1982; McGrath, 1982). Because of its low chemical reactivity and low solubility, indoor carbon monoxide levels usually are similar to outdoor levels.

3.4.3 Ambient Air Quality Conditions

Attainment Status Designations

The status of areas with respect to federal and state ambient air quality standards generally is categorized as nonattainment, attainment, or unclassified. However, this general terminology is used somewhat differently for federal versus state designations. State designations of attainment status are nonattainment (in violation of a state standard), transitional (in violation of a state standard but very close to attainment status), attainment (in compliance with a state standard), or unclassified (no data to determine status).

For most air pollutants, federal status designations initially are made as either nonattainment, unclassifiable, or attainment/cannot be classified. For simplicity and clarity, the federal unclassifiable and attainment/cannot be classified designations will be called unclassified throughout this EIS/EIR. Federal nonattainment designations for ozone, carbon monoxide, and PM_{10} normally include subcategories indicating the severity of the air quality problem (moderate or serious for carbon monoxide and PM_{10}; extreme, severe, serious, moderate, and marginal for ozone).

In the federal usage, the unclassified designation (either unclassifiable or attainment/cannot be classified) includes attainment areas that comply with federal standards as well as areas for which monitoring data are lacking. Unclassified areas are treated as attainment areas for most regulatory purposes. In the federal usage, formal attainment designations generally are used only for areas that transition from a nonattainment status to an attainment status. Areas that have been reclassified from nonattainment to attainment of federal air quality standards are automatically considered "maintenance areas" for the next 20 years, although this designation is seldom noted in status listings. Both nonattainment and maintenance areas are subject to the Clean Air Act conformity requirements discussed in a subsequent section.

Table 3.4-2 summarizes the federal and state attainment status designations for the counties that may be affected by one or more of the alternatives. For simplicity and clarity, the federal attainment status designations in Table 3.4-2 are characterized as nonattainment, maintenance, unclassified, or attainment. Federal Clean Air Act conformity requirements apply to the relevant pollutants in locations with federal nonattainment or maintenance designations. Pollutants with federal unclassified or attainment designations are excluded from consideration under Clean Air Act conformity requirements.

Table 3.4-2 does not address the new federal 8-hour ozone standard or the new federal $PM_{2.5}$ standards. As noted in Table 3.4-1, violation criteria for the new federal standards required 3 years of monitoring data. Nonattainment designations related to the new standards were not be made retroactively, and will not be made until issues raised by court challenges have been resolved.

Figure 3.4-1 illustrates the boundaries of the various federal nonattainment areas in the Salton Sea region. Most of the Salton Sea Air Basin has a nonattainment status for the federal 1-hour ozone standard. Most of the Riverside County portion of the air basin has a "severe" ozone nonattainment designation. The extreme eastern side of the Riverside County portion of the air basin has an unclassified (i.e., attainment) designation for the federal 1-hour ozone standard. The Imperial County portion of the air basin has a "moderate" ozone nonattainment designation.

Most of the Salton Sea Air Basin has a federal nonattainment designation for PM_{10}. The Riverside County portion of the air basin has "serious" PM_{10} nonattainment designation. The Imperial Valley portion of the air basin has a "moderate" PM_{10} nonattainment designation. The eastern portion of Imperial County has an unclassified (i.e., attainment) designation for the federal PM_{10} standards.

Air Quality Monitoring Data

Three air pollutants violate federal or state air quality standards in the Salton Sea Air Basin: carbon monoxide, ozone, and PM_{10}. Appendix C includes tabular and graphical summaries of monitoring data for these pollutants at various monitoring locations in the Salton Sea Air Basin. Carbon monoxide problems in the air basin are limited to the Calexico area. Ozone and PM_{10} problems occur intermittently throughout most of the air basin. As noted below, air quality conditions in the

Table 3.4-2
Federal and State Attainment Status Designations for Riverside, Imperial, and San Diego Counties

County	Subregion	Pollutant	Federal Status	State Status
Riverside County	South Coast Air Basin	Ozone	Nonattainment	Nonattainment
	Portion of County	Carbon Monoxide	Nonattainment	Attainment
		Nitrogen Dioxide	Maintenance	Attainment
		PM_{10}	Nonattainment	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment
	AQMA Portion of Coachella	Ozone	Nonattainment	Nonattainment
	Valley Planning Area	Carbon Monoxide	Unclassified	Attainment

		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Nonattainment	Nonattainment
		Sulfur Dioxide	Unclassified	Attainment
		Lead	no designation	Attainment
	Remainder of Coachella Valley Planning Area	Ozone	Unclassified	Nonattainment
		Carbon Monoxide	Unclassified	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Nonattainment	Nonattainment
		Sulfur Dioxide	Unclassified	Attainment
		Lead	no designation	Attainment
	Mojave Desert Air Basin Portion of County	Ozone	Unclassified	Nonattainment
		Carbon Monoxide	Unclassified	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Unclassified	Nonattainment
		Sulfur Dioxide	Unclassified	Attainment
		Lead	no designation	Attainment
Imperial County	City of Calexico	Ozone	Nonattainment	Nonattainment
		Carbon Monoxide	Unclassified	Nonattainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Nonattainment	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment
	Rest of Imperial Valley Planning Area Portion of County	Ozone	Nonattainment	Nonattainment
		Carbon Monoxide	Unclassified	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Nonattainment	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment

Table 3.4-2
Federal and State Attainment Status Designations for Riverside, Imperial, and San Diego Counties *(continued)*

County	Subregion	Pollutant	Federal Status	State Status
Imperial County	Remaining Eastern Part of County	Ozone	Nonattainment	Nonattainment
		Carbon Monoxide	Unclassified	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Unclassified	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment
San Diego County	Western 2/3 of County	Ozone	Nonattainment	Nonattainment
		Carbon Monoxide	Maintenance	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Unclassified	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment
	Eastern 1/3 of County	Ozone	Nonattainment	Nonattainment
		Carbon Monoxide	Unclassified	Attainment
		Nitrogen Dioxide	Unclassified	Attainment
		PM_{10}	Unclassified	Nonattainment
		Sulfur Dioxide	Attainment	Attainment
		Lead	no designation	Attainment

Sources: 40 CFR 81.305; California Air Resources Board, 1997.

Notes: PM_{10} = inhalable particulate matter
Federal and state attainment status designations do not always use the same geographic boundaries.
Subregion identifications in this table reflect the mixture of federal and state designation areas. In Riverside County, the Coachella Valley Planning Area (used for federal PM10 designation purposes) is larger than the AQMA boundaries used for federal ozone designation purposes. The Coachella Valley Planning Area represents the Riverside County portion of the Salton Sea Air Basin. In Imperial County, the City of Calexico has a different state carbon monoxide designation than the rest of the Imperial Valley Planning Area (used for federal PM10 designation purposes). Other federal and state attainment status designations apply to all of Imperial County.
Status designation categories for state air quality standards are nonattainment, transitional, attainment, or unclassified.
Status designation categories for federal ozone, carbon monoxide, nitrogen dioxide, and PM_{10} standards are either nonattainment or attainment/cannot be classified; attainment designations are made when areas are reclassified from nonattainment to attainment status. For clarity, federal attainment/cannot be classified designations are listed in this table as unclassified.
A federal redesignation to attainment for ozone, carbon monoxide, nitrogen dioxide, or PM10 implies maintenance area status; for clarity, such areas are listed as maintenance in this table.
Status designation categories for the federal sulfur dioxide standard are nonattainment of primary standard, nonattainment of secondary standard, attainment, or unclassified.
EPA is required to make nonattainment designations for the federal lead standard, but is not required to make formal attainment designations except when reclassifying an area from nonattainment to attainment. The absence of a formal designation implies attainment status.

Salton Sea Air Basin have been generally stable since 1992, with few upward or downward trends of any magnitude.

Carbon Monoxide. High carbon monoxide levels in the Calexico area are caused primarily by foreign vehicles which lack effective emission controls. The number of violations of federal and state carbon monoxide standards has fluctuated from year to year without any clear upward or downward trend.

Ozone. Most ozone problems in the Salton Sea Air Basin are caused by pollutant transport from the South Coast Air Basin (Los Angeles County, Orange County, western Riverside County, and southwestern San Bernardino County), San Diego County, or Mexico. Maximum 1-hour ozone concentrations have not shown any clear upward or downward trend in the air basin since 1991. The highest ozone concentrations generally occur in the Calexico area, with Palm Springs sometimes showing comparably high concentrations. Ozone concentrations in the Indio and El Centro areas tend to be slightly lower than those in either Calexico or Palm Springs.

The number of violations of the state ozone standard has historically been the highest in the Palm Springs area. In recent years, however, the number of violations of the state standard has declined at Palm Springs and Indio while the number of violations has risen somewhat at El Centro and Calexico.

Violations of the federal ozone standard are based on data for three-year periods, not single year totals. There has been a general decline in violations of the federal 1-hour ozone standard for Palm Springs and Indio. Data also suggest a recent decline in violations of the federal 1-hour ozone standard for the Calexico Grant Street station. In contrast, violations of the federal 1-hour ozone standard have been increasing at El Centro.

Ozone precursor emissions in the Salton Sea Air Basin for 1995 were estimated to be 58 tons per day of reactive organic compounds and 77 tons per day of nitrogen oxides, with emissions divided evenly between the Riverside County and Imperial County portions of the air basin (California Air Resources Board 1999).

PM_{10}. Violations of the state 24-hour PM_{10} standard are frequent at most monitoring stations in the air basin. Most monitoring stations also exceed the state annual average PM_{10} standard. Violations of the less stringent federal 24-hour PM_{10} standard are recorded occasionally at most monitoring stations in the air basin. The federal annual average PM_{10} standard is exceeded occasionally at Indio and Brawley, and is exceeded routinely in Calexico.

PM_{10} conditions in the Salton Sea Air Basin are due primarily to emission sources within the Salton Sea Air Basin, with additional contributions due to pollutant transport from the South Coast Air Basin or Mexico (Desert Research Institute, 1995). Major contributors to high concentrations of PM_{10} include wind-blown dust, agricultural burning, mining activities, vehicle travel on unpaved roads, motor vehicle emissions, and other fuel combustion sources. The most obvious sources of wind-blown dust are areas disturbed by agricultural practices or off-road vehicle activities, and vehicle travel on unpaved roads. Undisturbed desert areas would be a significant source of wind-blown dust only during periods of very strong winds. PM_{10} emissions in the Salton Sea Air Basin were estimated to be 191 tons per day in 1995, with most of the emissions (152 tons per day) occuring in the Imperial County portion of the air basin (California Air Resources Board 1999).

Most PM_{10} monitoring stations collect one 24-hour sample every six days. The relatively low frequency of sampling means that maximum concentration events are unlikely to be sampled in most years at any particular station. In addition, PM_{10} monitoring stations throughout the Salton Sea Air Basin normally are operated on the same basic six day cycle. Concurrent sampling simplifies comparisons among monitoring stations, but makes it more difficult to identify time history trends from maximum annual 24-hour PM_{10} data.

Annual average concentration values provide a more reliable indicator of annual trends and geographic patterns. PM_{10} concentrations are lowest in the Palm Springs area and highest in the Calexico area. PM_{10} concentrations between Indio and El Centro are very similar. Average PM_{10} levels in the Salton Sea Air Basin have remained very uniform over most of the 1991-1997 period. Average PM_{10} concentrations at Indio have shown a slight increase since 1992, while those at Calexico have shown a modest increase since 1995. There is no evidence from the monitoring data that the Salton Sea or surrounding land uses have any disproportionate impact on PM_{10} levels in the air basin.

Chloride, Sulfate, and Nitrate Content of PM_{10}. PM_{10} concentrations from some monitoring stations are analyzed for chloride, sulfate, and nitrate content. Data from these analyses provide some general indications about sources contributing to PM_{10} concentrations. The chloride content of PM_{10} can indicate the relative importance of marine air intrusion. In some situations, the chloride content might also indicate spray irrigation with moderately saline water, wind erosion of salt deposits in arid areas, or salt spray contributions from a large saline water body such as the Salton Sea. The sulfate and nitrate content of PM_{10} can indicate pollutant transport from heavily urbanized areas. In addition, the sulfate content can be an indication of fuel oil or diesel fuel combustion sources or of wind erosion from salt deposits in arid areas.

Except for the Palm Springs monitoring station, chloride, sulfate, and nitrate compounds in combination account for 8 percent -13 percent of average PM_{10} concentrations in the Salton Sea Air Basin. At the Palm Springs monitoring station, these constituents account for 14 percent - 20 percent of average PM_{10} concentrations.

There is a clear and consistent geographic pattern of declining chloride concentrations from the south end to the north end of the air basin. The chloride fraction of PM_{10} is highest in the El Centro and Calexico areas, and lowest in the Indio area. The chloride fraction of PM_{10} is higher at Palm Springs than at Indio, but is lower than that of the other monitoring stations in the air basin. The spatial pattern of chloride levels implies that marine air intrusion is the predominant influence on the chloride content of PM_{10}. There is no evidence that the Salton Sea or its shoreline areas have a measureable effect on chloride levels in the air basin.

Over the 1991 - 1997 period, there has been a slight decline in the chloride content of PM_{10} for the Imperial County portion of the air basin, and an increase in the chloride content of PM_{10} for the Riverside County portion of the air basin. Chloride levels in Palm Springs have shown a noticeable increase since 1993. Increased use of spray irrigation for residential landscaping and golf courses might account for this trend.

On an absolute concentration basis, PM_{10} sulfate levels are similar at all monitoring stations except Calexico. Calexico also has the highest overall PM_{10} concentrations in the air basin. The sulfate fraction of PM_{10} is similar for areas from Indio south to Calexico. PM_{10} samples from Palm Springs have a distinctly higher sulfate fraction than those from the rest of the air basin, suggesting a greater impact of pollutant transport from the South Coast Air Basin. There is no evidence that the Salton Sea has a measureable effect on sulfate levels in the air basin.

On an absolute concentration basis, there are no clear geographic patterns to PM_{10} nitrate levels. Indio and Calexico tend to have the highest average values, but the pattern is not consistent from year to year. The nitrate fraction of PM_{10} is similar for areas from Indio south to El Centro. PM_{10} samples from Palm Springs have a noticeably higher nitrate content than those from the rest of the air basin, suggesting a greater impact of pollutant transport from the South Coast Air Basin. The nitrate content of PM_{10} tends to be lowest in the Calexico area, suggesting a lower impact of pollutant transport from the South Coast Air Basin. There is no evidence that the Salton Sea has a measureable effect on nitrate levels in the air basin.

3.4.4 Air Quality Planning

Federal Requirements

The federal Clean Air Act requires each state to develop, adopt, and implement a state implementation plan (SIP) to achieve, maintain, and enforce federal air quality standards throughout the state. Deadlines for achieving the federal air quality standards vary according to air pollutant and the severity of existing air quality problems. The SIP must be submitted to and approved by EPA. In California, the state implementation plan consists of separate elements for different regions of the state. SIP elements are developed on a pollutant-by-pollutant basis whenever one or more air quality standards are being violated. Local councils of governments and air pollution control districts have had the primary responsibility for developing and adopting the regional elements of the California SIP.

Federal Clean Air Act Conformity Process

Section 176(c) of the Clean Air Act requires federal agencies to ensure that actions undertaken in nonattainment or maintenance areas are consistent with the Clean Air

Act and with federally enforceable air quality management plans. EPA has promulgated separate rules that establish conformity analysis procedures for transportation-related actions and for other (general) federal agency actions. Transportation conformity requirements apply to highway and mass transit projects funded or approved by the Federal Highway Administration or the Federal Transit Administration.

General conformity requirements are potentially applicable to most other federal agency actions, but apply only to those aspects of an action that involve on-going federal agency responsibility and control over direct or indirect sources of air pollutant emissions. Emission sources that are not under direct or indirect federal agency control are excluded from Clean Air Act conformity reviews under the EPA general conformity rule.

The EPA general conformity rule applies to federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specified thresholds. The emission thresholds that trigger requirements of the conformity rule are called *de minimis* levels. Table 3.4-3 identifies the federal nonattainment pollutants and the relevant *de minimis* emission thresholds for federal nonattainment areas in Imperial, Riverside, and San Diego counties. Figure 3.4-1 illustrates the boundaries of the various federal nonattainment areas in the Salton Sea region.

The EPA conformity rule establishes a process that is intended to demonstrate that the proposed federal action:

- Will not cause or contribute to new violations of federal air quality standards;
- Will not increase the frequency or severity of existing violations of federal air quality standards; and
- Will not delay the timely attainment of federal air quality standards.

Compliance with the conformity rule can be demonstrated in several ways. Compliance is presumed if the net increase in direct and indirect emissions from a federal action would be less than the relevant *de minimis* level. As noted above, the only emissions considered in this analysis are those emissions that are or will remain under the control of federal agencies.

Table 3.4-3
Federal Clean Air Act Conformity De Minimis Levels for Riverside, Imperial, and San Diego Counties

County	Geographic Area	Air District Jurisdiction	Nonattainment/ Maintenance Pollutant	Nonattainment Severity Classification	Precursors	De Minimis Threshold (Tons/Year)
Riverside County	South Coast Air Basin	South Coast AQMD	Ozone	Extreme	ROG, NOx	10
	Portion of County		Carbon Monoxide	Serious	CO	100
			Nitrogen Dioxide	Maintenance	NOx	100
			PM_{10}	Serious	PM_{10}, ROG, NOx, SOx	70
	AQMA Portion of Coachella Valley Planning Area	South Coast AQMD	Ozone	Severe	ROG, NOx	25
	Coachella Valley Planning Area	South Coast AQMD	PM_{10}	Serious	PM_{10}, ROG, NOx, SOx	70
Imperial County	Imperial Valley Planning Area	Imperial County APCD	PM_{10}	Moderate	PM_{10}, ROG, NOx, SOx	100
	Entire County	Imperial County APCD	Ozone	Transitional	ROG, NOx	100
San Diego County	Entire County	San Diego APCD	Ozone	Serious	ROG, NOx	50
	Western 2/3 of County	San Diego APCD	Carbon Monoxide	Maintenance	CO	100

Sources: 40 CFR 81.305; 40 CFR 93.153; California Air Resources Board, 1997.

Notes: APCD = Air Pollution Control District
AQMD = Air Quality Management District
ROG = reactive organic compounds
NOx = oxides of nitrogen
SOx = oxides of sulfur
PM_{10} = inhalable particulate matter
CO = carbon monoxide
De minimis thresholds apply to individual pollutants and precursors, not to the combination of precursors.

If net emissions increases exceed the relevant *de minimis* value, a formal conformity determination process must be followed. Federal agency actions subject to the general conformity rule cannot proceed until there is a demonstration of consistency with the SIP through one of the following mechanisms:

- By dispersion modeling analyses demonstrating that direct and indirect emissions from the federal action will not cause or contribute to violations of federal ambient air quality standards;
- By showing that direct and indirect emissions from the federal action are specifically identified and accounted for in an approved SIP;
- By showing that direct and indirect emissions associated with the federal agency action are accommodated within emission forecasts contained in an approved SIP;
- By showing that emissions associated with future conditions will not exceed emissions that would occur from a continuation of historical activity levels;
- By arranging emission offsets to fully compensate for the net emissions increase associated with the action;
- By obtaining a commitment from the relevant air quality management agency to amend the SIP to account for direct and indirect emissions from the federal agency action; or
- In the case of regional water or wastewater projects, by showing that any population growth accommodated by such projects is consistent with growth projections used in the applicable SIP.

Dispersion modeling analyses can be used to demonstrate conformity only in the case of primary pollutants such as carbon monoxide or directly emitted PM_{10}. Modeling analyses cannot be used to demonstrate conformity for secondary pollutants such as ozone or photochemically generated particulate matter because the available modeling techniques generally are not sensitive to site-specific emissions.

State Requirements

The California Clean Air Act of 1988 requires air pollution control districts and air quality management districts to develop air quality management plans for meeting state ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide. CARB is responsible for addressing actions required to meet state PM_{10} standards, but is not required to develop a formal plan for meeting the state PM_{10} standards.

The California Clean Air Act does not set specific deadlines for achieving state air quality standards. Instead, attainment is required "as expeditiously as practicable", with various emission control program requirements based on the attainment status for ozone and carbon monoxide standards.

3.4.5 Regulatory Considerations

Many types of industrial and commercial facilities require air quality permits for their equipment and operations. Local air pollution control districts are responsible for air quality permit programs in California. Permit authority is derived from a combination of state and federal legislation. In general, federally required air quality permit programs have been integrated into the pre-existing state and local permit program. This results in a two-step permit process for new stationary emission sources: an initial authority to construct (ATC) permit and a subsequent permit to operate (PTO).

Air quality permits would be needed for the enhanced evaporation system associated with some project alternatives. Air quality permits also may be needed for other fixed facilities (such as diesel engines used for pumping plants and electrical generators) that would be associated with some alternatives. The Imperial County APCD has permit authority within the Imperial County portion of the Salton Sea Air Basin. The South Coast AQMD has permit authority within the Riverside County portion of the Salton Sea Air Basin.

3.4.6 Meteorological Conditions

Temperature and Precipitation Patterns

Average temperature and precipitation conditions for the Salton Sea Air Basin are summarized in Appendix C. Temperature patterns are very similar throughout the air basin. Average daily high temperatures vary from about 71 degrees F during winter to about 105 degrees F during summer. Average daily low temperatures vary from about 40 to 45 degrees F during winter to about 70 to 75 degrees F during summer.

Annual precipitation quantities are greatest in the northern part of the Coachella Valley, and are relatively uniform and low throughout the Imperial Valley. Annual precipitation is less than 5.5 inches per year in the Palm Springs area, slightly above 3 inches per year in the Indio area, and about 2.5 inches per year throughout the Imperial Valley.

Regional Wind Patterns

An air basin perspective on wind direction patterns is provided by data summarized in California Air Resources Board (1984). Seasonal and annual average data for five locations in the Salton Sea Air Basin (Palm Springs, Indio, Thermal, El Centro, and Holtville) are presented in Appendix C.

Wind patterns in the Coachella Valley are influenced rather strongly by topographic features. Winds in the Coachella Valley generally are oriented in a northwest-southeast alignment. The predominant winds are from the northwest at all season for Palm Springs, Indio, and Thermal. Palm Springs experiences a secondary wind component from the east-southeast during all seasons. Thermal experiences seasonably variable secondary wind components from the south-southeast and north-northeast.

Topographic influences on wind patterns are less obvious in the Imperial Valley. Predominant wind patterns at the El Centro Naval Air Facility are from the west during most of the year. During the summer, southeast winds are predominant, together with a strong secondary component from the west. Wind patterns at Holtville in the eastern part of the Imperial Valley show both southeasterly and northwesterly or westerly components at all seasons. The northwest component dominates during winter, a westerly component dominates during spring, and the southeast component dominates during the summer. Southeasterly and northwesterly components are of similar magnitudes during the fall.

Local Wind Patterns

In the absence of strong frontal systems or strong gradients between high and low pressure areas which would generate a regionally dominant wind direction, winds from the Coachella Valley and Imperial Valley are likely to converge in the vicinity of the Salton Sea, creating complex airflow patterns. As a consequence of such factors, wind patterns over the southeastern part of the Salton Sea tend to differ from those over the northern part of the Sea (Cook et al., 1998).

The California Irrigation Management Information System (CIMIS) operates several meteorological monitorning stations in the Imperial and Coachella Valleys. Some of the monitoring stations are close to the Salton Sea and relatively close to facility sites associated with various alternatives. Recent data from some of these stations have been analyzed to determine wind direction and wind speed patterns. Detailed summaries of the data are presented in Appendix C. CIMIS station #154 is the monitoring site closest to the Bombay Beach EES site considered in Alternative 2. CIMIS station #127 is the monitoring site closest to the Salton Sea Test Base EES site considered in Alternatives 3, 4, and 5.

CIMIS station #154 is located near the northeast corner of the Salton Sea at the headquarters of the Salton Sea State Recreation Area. Only one year of complete data is available for this location. Wind direction patterns at the State Recreation Area site for 1997 are illustrated in Figure 3.1-3. Northwest and northeast winds were dominant during winter months. Southeast winds were dominant during spring and summer months. Fall months showed a transition from summer to winter directional patterns, with northwest, northeast, and southeast winds all making important contributions to directional patterns.

CIMIS station #127 is located near the boat ramp on the north side of Salton City (the boat ramp location is shown in Figures 2.5-2 and 3.12-6). Wind direction patterns for 1997 are illustrated in Figure 3.1-3. Northwest winds were dominant during all seasons. During winter months, there was a secondary component from the west and west-southwest. During spring and summer months, winds from the east-southeast became important secondary components. Fall months showed a return to the winter directional pattern, with winds predominantly from the north-northwest through west-southwest.

Comparison of 1997 wind patterns for Salton City and the State Recreation Area shows that predominant wind directions are roughly aligned with the long axis of the Salton Sea. Northwest winds are dominant at Salton City, while southeast winds are dominant on the opposite shore at the State Recreation Area. Off-shore winds make a secondary contribution during fall and winter months at both locations. Somewhat surprisingly, direct on-shore winds were infrequent at both locations. The basic wind pattern at both sites seems to be daytime valley axis winds and nighttime off-shore winds.

The low frequency of direct on-shore winds may be a consequence of converging winds from the Coachella Valley and Imperial Valley. The low frequency of direct on-shore winds also might be a consequence of water temperatures in the Salton Sea being too warm to generate a typical lake effect pattern of daytime on-shore winds and nighttime off-shore winds.

Local Wind Speed Frequencies

Direct comparison of wind speed data from the CIMIS stations with wind speed data from other monitoring sites is complicated somewhat by differences in instrument height. Wind speeds generally increase with height above the ground due to reduced friction effects of ground surfaces, vegetation, buildings, and other obstructions. The standard instrument height preferred by the National Weather Service is 10 meters (about 33 feet). Most CIMIS stations monitor wind conditions at a height of 2 meters (about 6.6 feet), which is more useful for assessing evaporation rates. The CIMIS station at the Salton Sea State Recreation Area (State Park site) monitors wind conditions at a height of about 5 meters (about 16 feet). To facilitate comparisons to other wind data, wind speed measurements from the CIMIS monitoring sites have been extrapolated to wind speeds at the standard 10-meter height.

Table 3.4-4 summarizes wind speed frequencies for the CIMIS State Recreation Area monitoring site (site #154) during 1997 (the only year of data available for that site). Wind speeds were highest during the winter, and lowest during the fall. As an annual average during 1997, wind speeds exceeded 15 mph only 4.8 percent of the time. Wind speeds exceeded 15 mph 9.3 percent of the time during winter months, 4.4 percent of the time during spring months, 2.3 percent of the time during summer months, and 3.3 percent of the time during fall months.

Table 3.4-5 summarizes wind speed frequencies for the CIMIS Salton City monitoring site (site #127) during 1997. Average wind speeds at the Salton City site were about 2 mph higher than those at the State Recreation Area site. Average

Table 3.4-4
1997 Seasonal and Annual Wind Speed Frequencies at the State Park Monitoring Site

WINTER 1997, STATE PARK SITE
Total Hours: 2,160
MEAN = 6.94 mph
MAXIMUM = 31.03 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	444	20.56%	79.40%
3	6	831	38.47%	40.93%
6	9	322	14.91%	26.02%
9	12	205	9.49%	16.53%
12	15	156	7.22%	9.31%
15	18	96	4.44%	4.86%
18	21	66	3.06%	1.81%
21	24	28	1.30%	0.51%
24	27	11	0.51%	0.00%
27	30	0	0.00%	0.00%
30	33	1	0.05%	0.00%

SPRING 1997, STATE PARK SITE
Total Hours: 2,208
MEAN = 6.35 mph
MAXIMUM = 27.18 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	421	19.07%	80.93%
3	6	831	37.64%	43.30%
6	9	553	25.05%	18.25%
9	12	178	8.06%	10.19%
12	15	128	5.80%	4.39%
15	18	59	2.67%	1.72%
18	21	19	0.86%	0.86%
21	24	10	0.45%	0.41%
24	27	8	0.36%	0.05%
27	30	1	0.05%	0.00%
30	33	0	0.00%	0.00%

SUMMER 1997, STATE PARK SITE
Total Hours: 2,208
MEAN = 6.09 mph
MAXIMUM = 21.69 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	336	15.22%	84.78%
3	6	941	42.62%	42.16%
6	9	611	27.67%	14.49%
9	12	157	7.11%	7.38%
12	15	113	5.12%	2.26%
15	18	34	1.54%	0.72%
18	21	13	0.59%	0.14%
21	24	3	0.14%	0.00%
24	27	0	0.00%	0.00%
27	30	0	0.00%	0.00%
30	33	0	0.00%	0.00%

FALL 1997, STATE PARK SITE
Total Hours: 2,138
MEAN = 5.37 mph
MAXIMUM = 25.24 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	542	25.35%	74.65%
3	6	1,001	46.82%	27.83%
6	9	340	15.90%	11.93%
9	12	108	5.05%	6.88%
12	15	76	3.55%	3.32%
15	18	47	2.20%	1.12%
18	21	15	0.70%	0.42%
21	24	6	0.28%	0.14%
24	27	3	0.14%	0.00%
27	30	0	0.00%	0.00%
30	33	0	0.00%	0.00%

Table 3.4-4
1997 Seasonal and Annual Wind Speed Frequencies at the State Park Monitoring Site *(continued)*

ANNUAL 1997, STATE PARK SITE				
Total Hours:			8,714	
		MEAN =	6.19 mph	
		MAXIMUM =	31.03 mph	
FREQUENCY DISTRIBUTION BY MPH RANGE:				
Lo End	Hi End	Hours	Percent	% Higher
-	-	-	-	-
0	3	1,743	20.00%	79.99%
3	6	3,604	41.36%	38.63%
6	9	1,826	20.95%	17.67%
9	12	648	7.44%	10.24%
12	15	473	5.43%	4.81%
15	18	236	2.71%	2.10%
18	21	113	1.30%	0.80%
21	24	47	0.54%	0.26%
24	27	22	0.25%	0.01%
27	30	1	0.01%	0.00%
30	33	1	0.01%	0.00%

Note: The anemometer height at the State Park site is about 5 meters. Measured wind speed values have been extrapolated to a standard10-meter height.

Table 3.4-5
1997 Seasonal and Annual Wind Speed Frequencies at the Salton City Monitoring Site

WINTER 1997, SALTON CITY SITE
Total Hours: 2,160
MEAN = 8.31 mph
MAXIMUM = 35.77 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	250	11.57%	87.59%
3	6	834	38.61%	48.98%
6	9	382	17.69%	31.30%
9	12	230	10.65%	20.65%
12	15	135	6.25%	14.40%
15	18	108	5.00%	9.40%
18	21	112	5.19%	4.21%
21	24	49	2.27%	1.94%
24	27	26	1.20%	0.74%
27	30	16	0.74%	0.00%
30	33	11	0.51%	0.00%
33	36	7	0.32%	0.00%
36	39	0	0.00%	0.00%

SPRING 1997, SALTON CITY SITE
Total Hours: 2,207
MEAN = 8.33 mph
MAXIMUM = 29.72 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	111	5.03%	94.97%
3	6	597	27.05%	67.92%
6	9	631	28.59%	39.33%
9	12	509	23.06%	16.27%
12	15	203	9.20%	7.07%
15	18	96	4.35%	2.72%
18	21	50	2.27%	0.45%
21	24	7	0.32%	0.14%
24	27	1	0.05%	0.09%
27	30	2	0.09%	0.00%
30	33	0	0.00%	0.00%
33	36	0	0.00%	0.00%
36	39	0	0.00%	0.00%

SUMMER 1997, SALTON CITY SITE
Total Hours: 2,207
MEAN = 9.29 mph
MAXIMUM = 29.22 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	70	3.17%	96.83%
3	6	433	19.62%	77.21%
6	9	612	27.73%	49.48%
9	12	603	27.32%	22.16%
12	15	297	13.46%	8.70%
15	18	111	5.03%	3.67%
18	21	63	2.85%	0.82%
21	24	12	0.54%	0.27%
24	27	4	0.18%	0.09%
27	30	2	0.09%	0.00%
30	33	0	0.00%	0.00%
33	36	0	0.00%	0.00%
36	39	0	0.00%	0.00%

FALL 1997, SALTON CITY SITE
Total Hours: 2,184
MEAN = 7.51 mph
MAXIMUM = 26.28 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	229	10.49%	89.51%
3	6	771	35.30%	54.21%
6	9	502	22.99%	31.23%
9	12	365	16.71%	14.51%
12	15	160	7.33%	7.19%
15	18	82	3.75%	3.43%
18	21	44	2.01%	1.42%
21	24	27	1.24%	0.18%
24	27	4	0.18%	0.00%
27	30	0	0.00%	0.00%
30	33	0	0.00%	0.00%
33	36	0	0.00%	0.00%
36	39	0	0.00%	0.00%

Table 3.4-5
1997 Seasonal and Annual Wind Speed Frequencies at the Salton City Monitoring Site *(continued)*

ANNUAL 1997, SALTON CITY SITE

Total Hours:		8,758
	MEAN =	8.37 mph
	MAXIMUM =	35.77 mph

FREQUENCY DISTRIBUTION BY MPH RANGE:

Lo End	Hi End	Hours	Percent	% Higher
0	3	660	7.54%	92.26%
3	6	2,635	30.09%	62.17%
6	9	2,127	24.29%	37.89%
9	12	1,707	19.49%	18.39%
12	15	795	9.08%	9.32%
15	18	397	4.53%	4.78%
18	21	269	3.07%	1.71%
21	24	95	1.08%	0.63%
24	27	35	0.40%	0.23%
27	30	20	0.23%	0.00%
30	33	11	0.13%	0.00%
33	36	7	0.08%	0.00%
36	39	0	0.00%	0.00%

Note: The anemometer height at the Salton City site (CIMIS station #127) is 2 meters. Measured wind speed values have been extrapolated to a standard 10-meter height.

wind speeds were highest during the winter, and lowest during the fall. As an annual average during 1997, wind speeds exceeded 15 mph 9.3 percent of the time. Wind speeds exceeded 15 mph 14.4 percent of the time during winter months, 7.1 percent of the time during spring months, 8.7 percent of the time during summer months, and 7.2 percent of the time during fall months.

3.5 NOISE

3.5.1 Introduction

The attenuation of noise levels with increasing distance from the noise source results in a fairly limited Phase I study area for noise issues. For this phase, the study area is within five miles of the Salton Sea. A more localized study area is appropriate for some discrete noise sources; such localized areas of influence are generally within half a mile of the noise source.

3.5.2 Noise Environment

Existing Noise Conditions

The primary sources of noise in the Salton Sea area include recreational activities, vehicle traffic, rail traffic, and agricultural equipment. Existing noise along the north shore of the Sea is dominated by vehicle traffic on State Route 86 and State Route 111 and agricultural equipment along the northeast shoreline. The Riverside County Comprehensive General Plan does not identify the Salton Sea as falling within 60 dB or higher noise contours from aircraft or roadway sources in Riverside County. The only activity proposed in this area is a potential fish processing plant on Torres Martinez Reservation lands and a shorebird and pupfish protection dike.

Existing noise sources along the east shore of the Sea include State Route 111 and the Southern Pacific Railway rail line. The Imperial County General Plan (1997) noise element identifies these areas as primary sources of noise along the Salton Sea. Other noise sources along the east shore include a fairly high level of recreational use associated with developed areas within the Salton Sea State Recreation Area; recreational noise sources including tent and RV camping, boating (powerboating and fishing), and other active recreational use of this area. The only activity proposed in this area is a potential EES east of the recreation area and State Route 111.

Existing noises sources along the south shore of the Salton Sea include State Route 86 and State Route 111, which are located further from the shoreline than along the rest of the Sea's perimeter, agricultural operations, and geothermal hydroelectric facilities on the southwest shore. The Imperial County General Plan (1997) noise element identifies State Route 86 and State Route 111 and a geothermal plant in the area southeast of the Salton Sea as primary sources of noise around the Salton Sea. Much of the south shore is made up of public lands, including the Sonny Bono National Wildlife Refuge, the Imperial County Wildlife Area-Wister Unit, and the inactive Salton Sea Test Base. The greatest area of wildlife sensitivity occurs along this part of the Sea and therefore may be more sensitive to noise. Recreational sources of noise include hunting and boating, though more passive forms of recreational activities result in lower levels of noise than recreational activities along the east shore. Potential activities proposed in this area include shorebird and pupfish protection ponds, concentration ponds, displacement dike, EES, and fish harvest pier.

The primary noise source along the west shore of the Salton Sea is State Route 86, which provides access to the greatest number of communities found around the Sea. Noise also stems from sport fishing, which occurs via some dirt roads but mainly via four boat ramps located in the communities within this area. The main activity proposed in this area is the northern reaches of a concentration pond.

3.6 FISHERIES AND AQUATIC RESOURCES

3.6.1 Introduction

The affected environment discussion for fish and aquatic resources is based on the food web established in the Sea. Because its inflow is largely agricultural drainage, the Sea receives large amounts of nitrogen and phosphorous. These nutrients create a rich environment for lower trophic levels, such as bacteria, phytoplankton, and phytobenthos. This productivity supports the higher trophic level represented by numerous fish species introduced to the Salton Sea. The aquatic food web of the Salton Sea is unique because it lacks an adult exclusively planktivorous (plankton-eating) fish. This puts added importance on bottom-dwelling organisms and limits success of some fish to forage from benthic substrate (Thiery 1999). A discussion of sport fishery in the Salton Sea, largely centered on orange-mouth corvina, also is included.

Aquatic habitats include freshwater marsh, cismontane alkali marsh, and open water and mudflats; the habitats are discussed in Section 3.8 of this report. The discussion of special status aquatic species is focused on fish and includes a discussion of the desert pupfish, the only fish species native to the Salton Basin (Thiery 1999). A discussion of the existing sport fishery also is provided.

The Phase I study area for fish and aquatic resources includes the Salton Sea, its tributaries, and adjacent shoreline and riverbanks. The ecosystem of the Salton Sea is composed of several components, which are discussed below.

The aquatic ecosystem in the Salton Sea has low diversity but high productivity, resulting from high nutrient loading from irrigation drain water. This eutrophic condition stimulates high primary productivity of phytoplankton and benthic (bottom-dwelling) algae, thus sustaining high secondary productivity of zooplankton and benthic worms, which create an extremely important decomposition energy pathway. This high productivity creates favorable conditions for fish that tolerate high temperatures, high salinity, and low concentrations of dissolved oxygen. However, at times, the decomposition of algal blooms resulting from excess nutrients diminishes the dissolved oxygen to levels that threaten the survival of aquatic resources. Conditions during algal blooms have been implicated in fish die-offs.

The low diversity in the Salton Sea ecosystem makes each link in the food web vital to the survival of species in the higher trophic levels. For example, the piscivorous (fish-eating) birds rely directly on the fish in the Salton Sea. Should the fish populations decline significantly, the piscivorous birds would decline as well. For this reason, there is great concern about adverse impacts from environmental pollutants and pathogens on the biota of the Salton Sea and its environs. Proper functioning of agricultural drainages is a vital part of the Salton Sea ecosystem operation. It is also a source of complex challenges to the ecosystem's viability. The water is vital but the excess nutrients and other environmental contaminants that it delivers to the Salton Sea are detrimental, particularly in combination with the avian and fish pathogens present there. Some studies examining contaminant (i.e. selenium) levels in fish and invertebrate tissue have been conducted in the Salton Sea. The results of these studies are discussed in Section 3.14, Public Health and Environmental Hazards.

3.6.2 Lower Trophic Levels

Bacteria

The abundance and significance of bacteria in alkaline saline lakes are not well understood or studied in general. Bacteria probably have a dual functional role, acting as both primary producers and decomposers. As with most saline lakes, the Salton Sea bacterial assemblage is virtually unstudied. There are purple and green sulfur bacteria present, but there have been no real attempts to study the open water or bottom-dwelling bacteria qualitatively or quantitatively. Levels of bacteria periodically are elevated at the south end of the Salton Sea as a result of elevated coliform bacterial levels in river discharge (RWQCB 1996).

Phytoplankton and Phytobenthos

Studies initiated in January 1998 in support of the CEQA/NEPA process included a focus on phytoplankton. The Sea is considered eutrophic, and phytoplankton is plentiful. This results in frequent algal blooms, often creating color changes and increased chlorophyll content in the Sea (Hurlbert 1999b). The dominant primary producers in the lake are phytoplankton and phytobenthos, microscopic plants that are found in the water column and benthic (bottom) habitats, respectively. The plant life in the Salton Sea is predominantly single-celled algae. Carpelan (1961) studied the Sea between 1954 and 1956 and found the major groups of algae to be diatoms (Chrysophyta), dinoflagellates (Pyrrophyta), and green algae (Chlorophyta). At that time, blue-green algae (Cyanophyta) also was found on the bottom of the Sea in shallow water and on buoys and pilings in the Sea.

In 1970, the USDI reported that the major species in the Salton Sea included diatoms (*Cyclotella caspia*, *Nitzchia longissima*, *Nitzschia* sp., *Pleurosigma* sp., *Thalassionema nitzschoides*), dinoflagellates (*Gyrodinium resplendens*, *Peridinium sp.*, *Cachonina niei*, *Exuviella* sp.), Euglenophyta (*Eutreptia* sp.), (*Westella botryoides*), and blue-green algae (*Oscillatoria* sp., *Phomidium* sp.).

During recent phytoplankton sampling efforts flourishing populations of three new sigmoid diatom species were observed (Hurlbert 1999c). These are *Gyrosigma balticum* (Ehrenberg) Rabenhorst, *Gyrosigma wormleyi* (Sullivant) Boyer, and *Pleurosigma ambrosianum*. The occurrence of *Gyrosigma balticum* (Ehrenberg) Rabenhorst so far inland is at least unusual if not unique. *Gyrosigma wormleyi* (Sullivant) Boyer is conventionally typified as a freshwater species; therefore, this finding is significant, and the ecology of this diatom must be extended to include saline habitats (Hurlbert 1999c). *Pleurosigma ambrosianum* is the dominant member of the plankton diatom assemblage during the winter. Samples collected prior to this most recent study indicated that many of the previously documented species are still present in the Sea. Hurlbert hypothesized (1999c) that the phytoplankton composition changes may be due both to an increase in salinity of the Sea, as well as from the introduction of tilapia, which includes plankton in its diet.

Invertebrates

There are five phyla of invertebrates represented within the Salton Sea: Protozoa, Rotifera, Nematoda, Annelida (segmented worms), and Arthropoda (crustaceans and insects). Some of the common invertebrates found in the Sea include ciliate protozoans, foraminifera (over two dozen species have been recorded in the Sea), *Brachionus plicatilis* (rotifer), *Apocyclops dengizicus* and *Cletocamptus dietersi* (copepods), *Balanus amphitrite saltonensis* (barnacle), *Neanthes succinea* (pileworm), *Gammarus mucronatus* (amphipod), and *Trichocorixa reticulata* (corixid, or water boatman). The rotifer *Brachionus plicatilis* is the dominant rotifer species in the Sea. It is completely planktonic and has great value as food for fish larvae. The pileworm *Neanthes* is considered a major food source for fish and some birds and thus is a significant species in the Sea benthos.

The major zooplanktonic organisms (microscopic animals) in the Salton Sea include *Brachionus*, the two copepods, the egg and larval stages of the pileworm, and the nauplia and cypris of the barnacle. Brine shrimp (*Artemia franciscana),* brinefly larvae (*Ephydra riparia*), and some surface-dwelling insects (*Trichocorixa reticulata*) occur in Salton Sea. The remaining organisms and life history stages are considered to be primarily benthic. Most habitats in the lake are soft-bottomed sand or silt, with only a few rocky areas. This means all organisms that need to attach permanently to a hard surface are limited to rocky areas, docks, discarded debris, or inundated brush along the shore.

3.6.3 Fishery Resources

Fishery resources in the Salton Sea area are present in canals, irrigation ditches, rivers, and the Sea itself. Fish make up the entire submerged Salton Sea megafauna. The impact fish have on the Salton Sea benthic community is unknown, although the fish feed on all adult macroinvertebrates, except the acorn barnacle *Balanus amphitrite* and its planktonic larvae. Most of the fish in the Sea have been introduced from the Gulf of California by the CDFG and have supported a highly productive sport fishery.

The fish community experiences periodic large-scale die-offs. The reason for these events is not entirely clear, but is likely the result of rapid declines in dissolved oxygen levels (Salton Sea Science Subcommittee Meeting 12/8/99). These declines in dissolved oxygen are due in part to seasonal algal blooms. Due to the large algal blooms, high temperatures and shallow depth of the Sea, these die-offs are likely to continue as long as the Sea supports large numbers of fish.

Introductions to the Sea

Since fish were first introduced in the early 1900s, the Sea has been characterized by changing fish communities. Initially freshwater species were introduced to the Salton Sea from the Colorado River during the Sea's initial formation. Though no published records exist, the fish were noted to be abundant in both numbers and species (Evermann 1916). As both the salinity and water level increased over time, the original freshwater fish species disappeared.

In 1929, a biological survey conducted by Coleman (1929) recommended the introduction of sport fish into the Salton Sea. Between 1929 and 1956, the CDFG made numerous transplants of both fish and invertebrates to develop a sport fishery in the Sea. Of the numerous species intentionally transplanted by CDFG, only the pileworm (*Neanthes*, introduced as fish forage), mudsucker, and three sport fish (orange-mouth corvina, sargo, and bairdiella,) survived.

The threadfin shad (*Dorosoma petenense*) was introduced accidentally to the Salton Sea via an irrigation canal in 1955 (Walker et al. 1961). This fish cannot reproduce in the Sea (Meyer Resources, Inc. 1988) and is probably present only in the tributaries. Two species of tilapia, Mozambique tilapia (*Oreochromis mossambicus*) and Zill's tilapia (*Tilapia zillii*) were recorded in tributaries near the Sea in 1964 and have contributed to the sport fish industry. The accounts vary as to which species exists in the Sea, but it is most likely a hybrid of Mozambique tilapia (Meyer Resources Inc. 1988; Black 1981). Further research on the tilapia resources of the Salton Sea are currently being conducted by Barry Costa-Pierce.

Today, the Salton Sea supports numerous species of fish, including sailfin molly (*Poecilia latipinna)*, porthole livebearer (*Poeciliopsis gracilis)*, longjaw mudsucker (*Gillichthys mirabilis)*, mosquitofish (*Gambusia affinis affinis*), tilapia (*Oreochromis mossambicus* and *Tilapia zillii*), bairdiella (*Bairdiella icistia)*, sargo (*Anisotremus davidsoni)*, and orange-mouth corvina (*Cynoscion xanthulus)*. Each of these species is briefly described below.

Desert pupfish (*Cyprinodon macularius)* is currently the only known special status speices occurring in the Sea. This species is discussed in Section 3.6.4. Bairdiella, sargo, and corvina are marine species, while the remaining species are estuarine or freshwater fish with extreme salinity tolerances.

Tilapia

The most abundant species present in the Salton Sea, tilapia, is an introduced warm-water cichlid from Africa used in mosquito and weed control, commercial fish farming, and as an aquarium fish. Tilapia is a robust fish weighing up to 3.53 pounds and growing to 15.8 inches. Tilapia are mouth brooders (females carry the eggs and young fry in their mouths) and may spawn five to eight times per year. Tilapia are omnivorous, feeding on plankton, insects, larvae, crustaceans, and plant material. They are the major food source for corvina (a sport fish), pelicans, and other fish-eating birds; tilapia itself is an important sport fish (Black 1981; Meyer Resources Inc. 1988).

Tilapia migrate long distances and disperse their progeny widely beyond the area of initial introduction. As a result, tilapia can quickly overpopulate suitable environments and affect native fish and habitats. Tilapia have been blamed for the decline of the endangered desert pupfish in the Salton Sea.

Three species of tilapia may inhabit the Sea and associated tributaries/canals. Each of these species that inhabit the Sea is discussed below.

Zill's Tilapia (Tilapia zillii). *Tilapia zillii* is native to Africa. *T. zillii* is noted for its hardiness and can tolerate wide temperature ranges (7-42°C). *T. zillii* was imported to southern California for its ability to feed on nuisance aquatic weeds and other macrophytes, which were clogging irrigation canals.

T. zillii has high fecundity and frequent spawning periodicity, a slow overall growth rate to a small maximum size, and a narrow temperature optimum for good growth.

Mozambique Tilapia (Oreochromis mossambicus). Mozambique tilapia, or mouthbrooder, is one of the most widely spread exotic animals in the world. By 1968, this species of tilapia had been found in some 15 miles of irrigation canals (the Araz Drain and Reservation Main Drain) near Bard in Imperial County, California (Costa-Pierce 1999). The Salton Sea Science Subcommittee is investigating this species via the ongoing reconnaissance studies (Costa-Pierce 1999). Since it was not legally stocked into southern California waters until 1971 (Costa-Pierce 1999), tilapia likely represent rapid colonization from irrigation canals connected to California water.

Wami River Tilapia (Oreochromis urolepis hornorum). The Wami River tilapia originates from the Wami River in eastern Tanzania. The Wami River tilapia is famous for its role as the male parental stock used with female *Oreochromis mossambicus* to produce "all male" hybrid progeny (Costa-Pierce 1999). An all- male hybrid tilapia that could not reproduce excited worldwide interest. As a result, the Wami River tilapia was exported worldwide for aquaculture development and environmental control. The Salton Sea Science Subcommittee is investigating this tilapia species via the ongoing reconnaissance studies (Costa-Pierce 1999).

Anywhere in the tropical and subtropical aquatic environment where tilapia is introduced, there is a risk of interbreeding and hybridization among populations that may be distinct in the wild but reproductively compatible. Where a mixture of tilapia species has been stocked, reproductively viable hybrids have resulted (Costa-Pierce 1999). Hybrids of *Oreochromis mossambicus* x *Oreochromis urolepis hornorum* were stocked extensively into the Salton Basin to the point that it is unlikely that pure species lines of Wami River tilapia or Mozambique tilapia exist.

The salinity and temperature thresholds for the hybrid tilapia are not well understood; it is known, however, that the Mozambique tilapia has a wide salinity tolerance but a low tolerance for large fluctuations in water temperature (Costa-Pierce 1999). This likely holds true for the hybrid, which experiences large die-offs at the Salton Sea during periods of high water temperatures in the spring and summer and low water temperatures in the winter (Meyer Resources Inc. 1988; USFWS 1996). Further studies on tilapia ecology at the Salton Sea are being conducted (Costa-Pierce in prep.).

Bairdiella

Bairdiella, or gulf croaker, is native to the Gulf of California. It is common in shallow and moderate depths. The Salton Sea population stems from 67 fish introduced in 1950 to 1951 by CDFG (Walker et al. 1961). By 1952, sampling in the Sea indicated a sizable population (Walker et al. 1961). Bairdiella are small silvery fish and weigh on average about 5.6 ounces and grow to about 9.8 inches.

The diet of the young of the year consists of copepods and their larvae, barnacle larvae, fish eggs, and smaller larvae of their own. The adults feed primarily on pileworms (Quast 1961) and probably other invertebrates. Bairdiella are an important source of food for corvina however, little is known about the current population status of Bairdiella in the Salton Sea.

Sargo

Sargo have a native range from Point Conception, California, to southern Baja California and the upper Gulf of California. The population in the Salton Sea stems from the 65 fish introduced in 1951. Initially, they did not show an explosive increase. Evidence of spawning occurred in 1957, and by 1960 there was a large enough population to support a sport fishery (Walker et al. 1961).

Sargo has been reported to exceed a length of 17 inches. In the Salton Sea it has been reported to reach 2.2 pounds in weight and 13.8 inches in length. It has a deep body, a strong spinous first dorsal fin, and three strong spines in the anal fin. A black bar extends below the fifth and seventh dorsal spine. With its increase in numbers, the sargo became an important gamefish and forage fish in the Sea (Walker et al. 1961; Meyer Resources Inc. 1988). Its numbers, however, have greatly declined, and its present population status in the Sea is unknown.

Orange-mouth Corvina

Orange-mouth corvina has a native range within the Gulf of California. It was planted in the Salton Sea at various times between 1950 and 1955. It increased substantially to form the sport fishery in the Salton Sea (Walker et al. 1961), where it is considered the chief game fish. It is a long fish, with a tan back and silvery sides and can weigh over 30 pounds and grow to 42.5 inches. It has two almost separated dorsal fins and two anal spines. It was introduced at the same time as short-fin corvina, which showed initial signs of acclimation but was not able to spawn in the Sea.

The diet of young of the year corvina consists of barnacle nauplii and other plankters. When they are 1.2 to 2.4 inches, the young feed primarily on pileworms or other invertebrates. The adults feed on the fry and young of the year of tilapia, bairdiella, and other fish of appropriate size. Field data collected between 1987 and 1989 with salinities of 38,000 and 44,000 mg/L, respectively, showed a decrease in number of ichthyoplankton (larval fish) as a result of significant decline in both the late egg and early larval stages for corvina (Matsui et al. 1991b). However, a sport fishery still exists in the Sea.

Sailfin Molly

Sailfin molly has a native range along the east coast of North America, from North Carolina to the Yucatan Peninsula. The population in the Salton Sea is believed to have stemmed from escapes/releases from tropical fish farms in the 1960s (St. Amant 1966). Sailfin mollies inhabit freshwater and saltwater marshes, ponds, and ditches (Herbert et al. 1987). It is an oblong fish, reaching over 4.7 inches in length. It differs from most other freshwater species in that the females carry the developing eggs until they hatch internally, and the young emerge from the female alive (Eddy and Underhill 1978). Sailfin molly feeds on plants and small organisms associated with detritus and opportunistically on insects and their larvae (Eddy and Underhill 1978; Herbert et al. 1987). The species is tolerant of wide ranges of salinity (Herbert et al. 1987), and adults are reported to withstand salinities greater than 80,000 mg/L (Nordlie et al. 1992; Herre 1929).

Porthole Livebearer

Porthole livebearer native range includes Central America and southern Mexico (Lee et al. 1980). It probably was introduced through escapes/releases from tropical fish farms in the 1960s (Mearns 1975).

Longjaw Mudsucker

Longjaw mudsucker has a native range from central California to the Gulf of California. The Salton Sea population stems from 500 fish introduced in 1930 by CDFG (Walker et al. 1961). It is found mostly inshore around cover and quiet water (Walker et al. 1961). The longjaw mudsucker reaches a length of 5.5 inches. It has a long upper jaw reaching to the posterior part of the head. It is able to withstand high salinities and has been collected in the field with salinities of 83,000 mg/L (Barlow 1963).

The longjaw mudsucker diet consists of harpacticoid copepods, larvae, and nematodes for the juveniles and *Neanthes*, barnacles, juvenile pupfish, mudsuckers, and tilapia for the adults. It has value as a baitfish for corvina and historically was numerous enough at the Sea to support a small bait fishery. During certain seasons, longjaw mudsucker may be an important food item for corvina (Walker et al. 1961).

Mosquitofish

Mosquitofish has been introduced around the world for mosquito control, hence the common name, which it shares with at least five other fish species, including the guppy. Unfortunately, *G. affinis* is not as good at eating mosquitoes as the fishes it tends to replace in those new locations. Mosquitofish tend to replace native fishes where it is introduced, probably through competition for food and aggressive interactions. Mosquitofish is an aggressive fry eater and may feed on the fry of its neighbors, as well as on mosquito larvae or eggs.

3.6.4 Special Status Species

One of the 41 species of fish known to occur or that may occur in the Sea is considered sensitive by state or federal resource agencies. This species is the desert pupfish (*Cyprinodon macularius*).

Desert Pupfish

Desert pupfish is the only native species in the Salton Sea. It is both a California endangered species and a federally endangered species (Federal Register 51(61):10842-51). This is the largest of the North American pupfish. Although it may reach three inches in length, it is seldom more than half that size. Desert pupfish is a chubby, thick-bodied and slab-sided (Schoenherr 1990) fish. The females are pale with brownish blotches, and the males are brightly colored during the spring and summer with blue backs and golden bellies. Desert pupfish is an opportunistic feeder whose diet varies seasonally with food availability (Naiman 1979). Its diet consists of algae, minute organisms associated with detritus, insects, fish eggs, and small crustaceans (Cox 1972; Naiman 1979). It is not considered an important food for wading birds and other fish because of its low numbers (Walker et al. 1961; Barlow 1961).

Desert pupfish has a high tolerance for extreme environmental conditions, including ranges of temperature, dissolved oxygen, and salinity (Barlow 1958). Barlow (1958) reported that the adult desert pupfish survived salinity as high as 98,100 mg/L in the laboratory.

Although desert pupfish is extremely hardy in many respects, it prefers quiet water with aquatic vegetation (Schoenherr 1990), and it cannot tolerate competition or predation and thus is readily displaced by exotic fishes (USFWS 1986). It prefers backwater areas, springs, streams, and pools along the shoreline of the Salton Sea. Distribution of the desert pupfish and its designated critical habitat (after Sutton 1999) is shown in Figure 3.6-1.

Historically, desert pupfish were abundant along the shore of the Salton Sea through the 1950s (Barlow 1961). During the 1960s, the numbers declined, and by 1978, they were noted as scarce and sporadic (Black 1980). Declines are thought to have resulted from the introduction of tilapias into the Salton Sea (Bolster 1990).

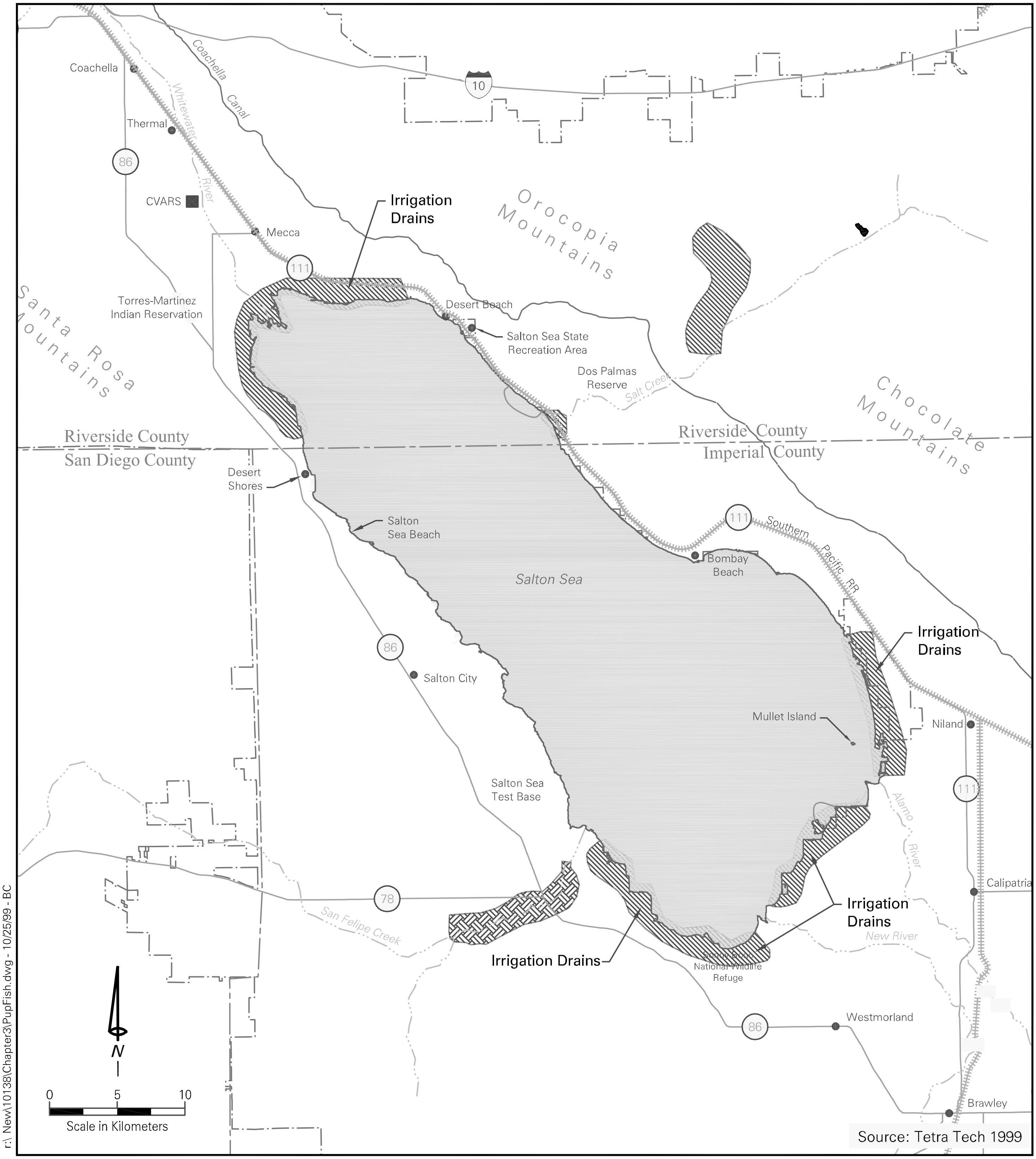
Surveys conducted by the US Fish and Wildlife Service (USFWS) to determine their distribution around the Salton Sea indicated that desert pupfish were present in more than fifty localities in canals and shoreline pools on the southern and eastern margins of the Salton Sea (Lau and Boehm 1991), and in small pools in Felipe Creek, Carrizo Wash, and Fish Creek Wash near the Salton Sea. Localities also include agricultural drains in the Imperial and Coachella valleys, shoreline pools around the Salton Sea, the mouth of Salt Creek in Riverside County, lower San Felipe Creek and its associated wetlands in Imperial County, and eight artificial refuge ponds (Bolster 1990; USFWS 1999).

Sutton (1999) observed desert pupfish movement between the Sea and nearby drains. Pupfish were observed moving from both irrigation drains and Salt Creek downstream into shoreline pools. The reverse movement from shoreline pools upstream into both drains and Salt Creek was also observed. The best evidence of movements were observed in the southwestern area between Trifolium 20A and a connected shoreline pool. These observations indicate the importance of agricultural drains as pupfish habitat and the potential for pupfish to use shoreline aquatic habitats as corridors. This potential movement may be important in providing genetic mixing between various populations.

3.6.5 Sport Fishery

The Salton Sea sport fishery consists sargo, bairdiella, orange-mouth corvina, and tilapia. The tilapia catch represents the first reported California sport fishery for this genus.

All of the sport fishes but tilapia are serial spawners, producing pelagic externally fertilized eggs during May, June, and July. Sargo generally spawns from February through July, peaking in March, biardiella from April to August, peaking in May, and corvina from May until July, peaking in June. Little information is available on the early development of the orange-mouth corvina.



Legend

Pupfish Critical Habitat

Other Known Pupfish Areas from 1983 Survey

Distribution of Desert Pupfish and Designated Critical Habitat

Salton Sea, California

Figure 3.6-1

The lack of an effective planktivorous fish means that the productivity of the Sea has to travel through the benthos before reaching the fishery. There is, however, a question about the effectiveness of bairdiella, historically the most important forage fish, in benthic feeding. Whitney (1961) reported that the plumpness of bairdiella correlated closely with the occurrence of pileworm swarming. This implies that bairdiella could not reliably feed on pileworms directly from the bottom of the Sea. If pileworm swarming were as highly seasonal in the Salton Sea as it is in other habitats, it is possible that bairdiella would not survive in the Sea. This apparent benthic feeding limitation of bairdiella may also explain their partial replacement by *Tilapia mossambica*, which has a well-developed ability to forage food directly from benthic substrate (Costa-Pierce 1999).

Whether via bairdiella or tilapia, the Salton Sea food chain leading to corvina, the primary sport fish, consists of the following five or six steps: phytoplankton to zooplankton to bacteria/foraminifera to pileworm to bairdiella/tilapia to corvina. In most lakes, the chain to reach a similar-sized sport fish would be only the four steps of phytoplankton to zooplankton to planktivorous fish to piscivorous fish (sport fish).

The successful and adaptive nature of the Salton Sea's invertebrate fauna seems to indicate continued resilience for the Sea's community as a whole, but the pattern and length of the food chain places the sport fishery at considerable risk.

3.7 BIRD RESOURCES

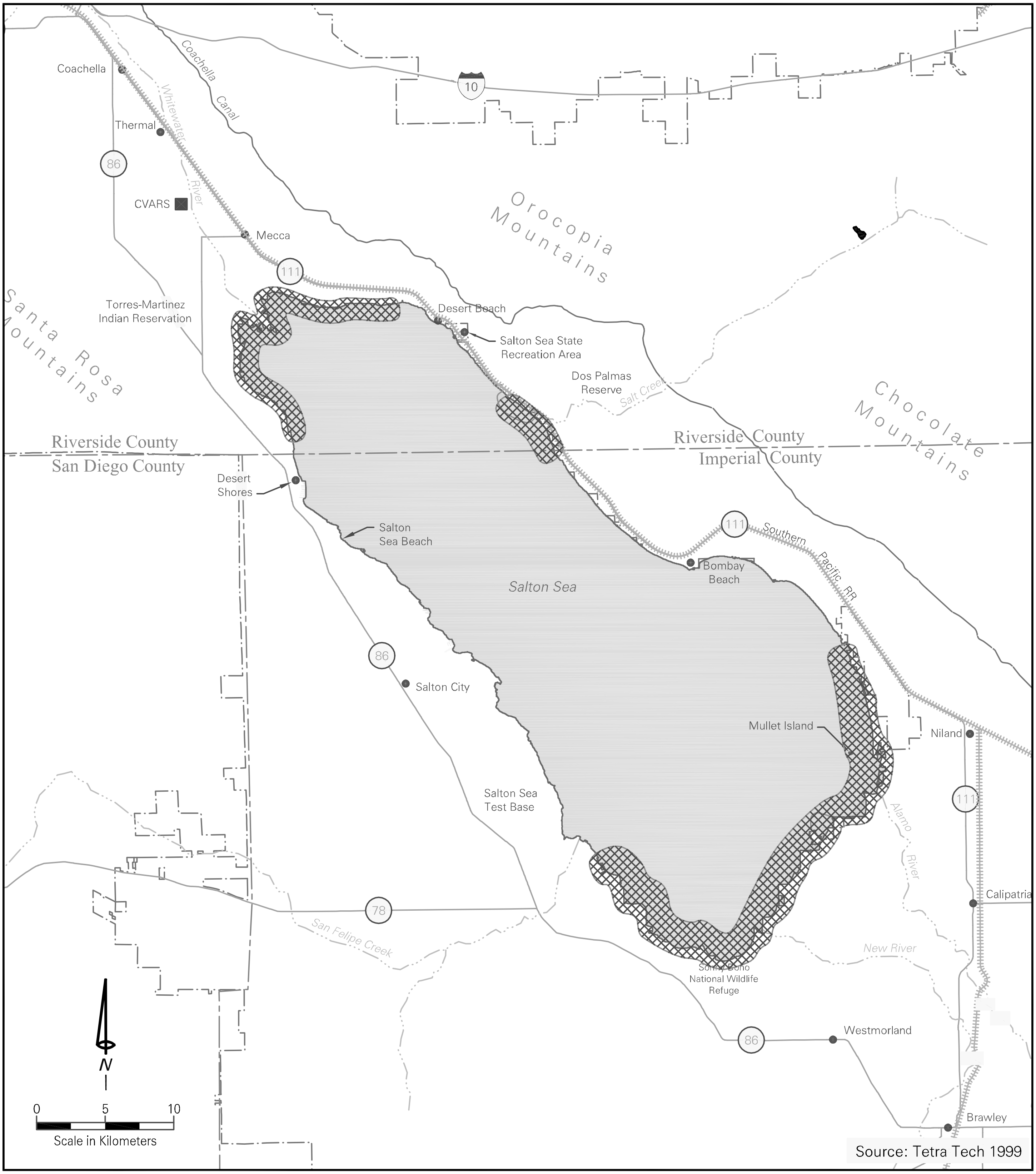
3.7.1 Introduction

The affected environment discussion for avian resources includes resident species, migratory species, and special status species. The discussion of resident and migratory species is broken down by foraging guilds, with an emphasis placed on waterbirds. The special status species presented are bird species that are listed as endangered, threatened, or of special concern by the US Fish and Wildlife Service or the California Department of Fish and Game. The Phase I study area for avian resources is defined as Imperial and Riverside counties. Data from studies on the Salton Sea being conducted through the Salton Sea Science Subcommittee has been incorporated into this section and into Section 4.7, as appropriate. When these studies are completed, the additional data will be used to analyze impacts of future actions.

The Salton Sea has become the center of avian biodiversity in the American Southwest, supporting over 400 species and averaging over 1.5 million birds annually. For example numbers of eared grebes alone have reached as many as 3.5 million birds at the Sea (Point Reyes Bird Observatory 1999). The Sea is an integral part of the Pacific Flyway, providing essential habitat for both resident and migrant species. The breeding bird communities on the Salton Sea represent a significant proportion of the breeding populations of many of these species. In addition, numerous species of migratory waterfowl depend on Salton Sea habitats. From 1978 to 1987 mid-winter waterfowl numbers averaged over 75,000 and 60,000 were counted in January 1999 alone (Point Reyes Bird Observatory 1999). The Sea and adjacent wetlands, river systems, natural habitats, and agricultural fields provide foraging and roosting opportunities for large numbers of birds. An estimated 97 percent of California's wetlands have already been converted to other uses (US Fish and Wildlife Service 1999), including the loss of suitable habitat in the Rio Colorado Delta area, causing the Salton Sea to become increasingly important for birds. In general, the highest avian use occurs in the southern and northern portions of the Sea (see Figure 3.7-1) (Point Reyes Bird Observatory 1999). Observed nesting colonies in use during 1999 include; cormorants on Mullet Island, islands near Wister Unit, and near the Whitewater River; herons and egrets along the southeast and southwest shoreline, and in snags near the Whitewater River; and terns and skimmers near the Alamo and Whitewater Rivers (Point Reyes Bird Observatory 1999).

Since the early 1990s, there has been an unprecedented series of fish and bird die-offs at the Salton Sea (Kuperman and Matey 1999). A variety of diseases have been diagnosed and some mortality remains undiagnosed despite extensive efforts. Studies seem to indicate that bacterial and viral pathogens are involved but that they are not necessarily the only cause of this mortality. The diseases include avian botulism associated with bacterial toxin (US Fish and Wildlife Service/National Wildlife Refuge 1996), Newcastle disease associated with a virus, and avian cholera and Newcastle disease both from bacterial sources. Recent events include a die-off of 4,515 cattle egrets in 1989 from salmonellosis (US Fish and Wildlife Service/National Wildlife Refuge 1996-1997), a die-off of an estimated 145,000 eared grebes in 1992 (Rocke 1999), loss of 15,000 pelicans and other fish-eating birds in 1996 from avian botulism (which killed over 10 percent of the western white pelican population) (Rocke 1999), a die-off of 6,845 birds in 1997 (Rocke 1999), and loss of 18,410 birds in 1998 from a variety of agents, including avian cholera, Newcastle disease, avian botulism, and salmonella (US Fish and Wildlife Service /National Wildlife Refuge 1998-1999). Avian disease has been present at the Sea for many years. The recent increase in disease occurrence, magnitude of losses, and variety of disease is indicative of an ecosystem under severe stress (Friend 1999). The varieties of diseases present have individual ecological relationships that must be determined to provide a sound foundation for addressing disease prevention and control. These relationships may include interactions between different types of disease agents (i.e., chemicals and microbes) in addition to abiotic aspects of the environment.

Preliminary studies have also shown increased selinium levels in white and brown pelicans (Burehler and de Peyster 1999). Comparison of samples from 19 birds from the Salton Sea and 4 birds from Sea World of California showed that the mean concentrations of selenium in liver tissue were significantly higher in both brown and white pelicans from the Salton Sea compared with pelicans from Sea World. There is also some indications that selinium my play a role in supression



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Legend

Areas of Heaviest Avian Use

Avian Use

Salton Sea, California

Figure 3.7-1

of the immune system of some birds (Fairbrother and Fowles 1990) and that the increased selinum levels in the pelicans may make them susceptible to botilism and other diseases. However, Burehler and de Peyster caution about making a direct correlation between selenium levels and increased bird dieoffs as many other factors may be contributing to this phenomenon.

3.7.2 Bird Species

Waterbirds represent the higher trophic levels of the food web of the Salton Sea and surrounding areas. The primary food resources in the Salton Sea are fish and aquatic invertebrates; but aquatic plants, terrestrial invertebrates, amphibians, and reptiles found along shorelines and in adjacent fresh/brackish water wetlands and agricultural drainage systems also provide food. Some species roost on the Sea but forage for grains, plants, terrestrial invertebrates, amphibians, reptiles, birds, and small mammals in surrounding agricultural fields and natural habitats. Certain species of raptors hunt for avian prey at the Sea or in neighboring habitats.

Waterbirds can be categorized into guilds based on their primary methods of foraging. Over 50 percent of waterbird species at the Salton Sea belong to guilds that forage in shallow water of the Sea and adjacent wetlands or that probe and glean for food along shorelines, mudflats, and in agricultural fields. About 20 percent of species feed on fish in deeper waters. The wader/shallow water foraging guild has the highest number of species occurring at the Salton Sea and in adjacent wetlands, followed by the ground gleaners, the probers, the generalists, bottom feeders, water column divers, plunge divers, predators, surface feeders, and hawkers. A number of these species, such as cattle egrets, geese, white-faced ibis (*Plegadis chihi*), long-billed curlews (*Numenius americanus*), and blackbirds, roost on the Salton Sea but forage primarily in adjacent agricultural lands.

The most numerous waterbird species at the Salton Sea is the eared grebe (*Podiceps nigricollis*), with 65,000 to 700,000 individuals annually (US Fish and Wildlife Service 1996). This is followed by black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and ring-billed gull (*Larus delawarensis*), each with an estimated 100,000 individuals. Northern shoveler (*Anas clypeata*) is fifth in abundance (60,000 individuals), followed by long-billed dowitcher (*Limnodromus scolopaceus*), with a population of 50,000, and ruddy duck (*Oxyura jamaicensis*), with 42,000 individuals.

The Salton Sea provides important food sources, especially fish and invertebrates, for many foraging waterbirds. Other birds rest on the Sea and along shorelines, foraging on plants and invertebrates in agricultural fields, and in natural habitats in the Imperial and Coachella valleys. Of those species typically occurring at the Salton Sea and in adjacent wetlands, primary food sources were categorized and ranked for each species using dietary information from Ehrlich et al. (1988), Bellrose (1980), and IID (1994). Aquatic invertebrates are the highest ranked food sources used by the 101 waterbird species. The second highest ranked food resource is terrestrial invertebrates, followed by fish, vegetative material (includes aquatic and terrestrial plant parts except for seeds), and seeds. Other food sources include small vertebrates (amphibians, reptiles, and small mammals), scavenged foods (garbage, carrion), avian prey, and plankton.

Most of the 101 species that depend on the Salton Sea and adjacent wetlands are winter visitors or migrants, and about 27 percent of waterbird species regularly breed at the Salton Sea. Over 80 percent of the breeding species occur as year-round residents, while the remainder are summer visitors. A small proportion of winter or spring visitors that sporadically breed at the Salton Sea augments the breeding population. Four percent of species are post-breeding visitors, and only one species occurs year-round as a nonbreeder.

Following is a description of waterbird foraging guilds found in the waters and along the shorelines of the Salton Sea and in adjacent fresh/brackish water ponds, marshes, agricultural drainage ditches, and riparian habitats, along with a description of some representative species found at the Salton Sea.

The ***wader/shallow foraging guild*** includes birds that use shallow waters, often along the edge of the Sea or in adjacent wetlands to forage for invertebrates, fish, other small vertebrates, or submerged aquatic vegetation. This guild is largely made up of herons, egrets, geese, and dabbling ducks.

Great blue heron (*Ardea herodias*) is the most widespread of all North American herons and is found throughout most of California (Zeiner et al. 1990a). At the Salton Sea, this species is a common year-round resident, with a population of 500 individuals (IID 1994). In 1992, great blue heron were reported nesting at Finney Lake near the south end of the Salton Sea. Great blue heron typically nests in colonies using large trees to support their substantial platform nests. Great blue heron forage in shallow water for fish, aquatic invertebrates, and small vertebrates. This species has declined in California in part because of a loss of wetland habitats and is considered sensitive at nesting colonies because human disturbance and activity at a colony may cause nest desertion (Zeiner et al. 1990a).

In California, great egret (*Casmerodius albus*) is distributed throughout the coastal lowlands and the Central Valley as a winter visitor or year-round resident (Zeiner et al. 1990a). Great egret is a common year-round resident at the Salton Sea, with an annual population of about 300 individuals (US Fish and Wildlife Service 1993; IID 1994). Small numbers nest at Finney Lake near the south end of the Salton Sea. This species is similar to the great blue heron in foraging habits and nesting requirements.

Snowy egret (*Egretta thula*) is distributed throughout much of California as a winter visitor and nesting resident (Zeiner et al. 1990a). It is a common year-round resident at the Salton Sea, with a population of 500 to 1,000 individuals (US Fish and Wildlife Service 1993; IID 1994). This species nests at the Salton Sea at such locations as Finney Lake and Sonny Bono Salton Sea National Wildlife Refuge. It has been displaced by the cattle egret at several nesting colonies in the Salton Sea area (Garrett and Dunn 1981; Rosenberg et al. 1991). Snowy egret forages for a variety of foods in shallow water and nests in dense emergent wetland vegetation and in trees. Reasons for the decline of snowy egret in California include competition for nest sites with cattle egret, abandonment of nesting colonies because of human intrusion, and a susceptibility to pesticides and herbicides in foraging and nesting habitats (Zeiner et al. 1990a).

The ***prober foraging guild*** is characterized by birds (includes many shorebirds) that probe with their bills for invertebrates on or along exposed sandy beaches, mudflats, and submerged shoreline.

Long-billed curlew (*Numenius americanus*) is a common winter visitor and a spring and fall migrant to the Salton Sea, with a peak population of up to 20,000 individuals (US Fish and Wildlife Service 1993; IID 1994). It probes for terrestrial and aquatic invertebrates in wetlands and agricultural fields. Long-billed curlew has declined, largely as a result of loss of prairie nesting habitat.

Bottom feeders dive underwater and forage on the bottom of the Sea and in neighboring freshwater ponds for invertebrates and submerged vegetation. Typically, this guild forages in deeper waters than the wader/shallow water guild. The bottom feeding guild includes diving duck species, such as canvasback (*Aythya valisineria*), scaup species, goldeneye, bufflehead (*Bucephala albeola*), and ruddy duck (*Oxyura jamaicensis*).

The ***water column diver*** guild is composed of cormorants, grebes, and mergansers that dive under the surface of the water to various depths and forage for fish.

An estimated 5,000 year-round resident and migrating western grebes (*Aechmophorus occidentalis*) occur at the Salton Sea (IID 1994). This species dives through the water column, primarily foraging for fish. Western grebes breed at the Salton Sea, using the open waters for courtship, foraging, and flocking and using the adjacent wetlands for nesting. This species typically nests in colonies using emergent vegetation (e.g., tules and cattails) to anchor nests. Western grebe is declining throughout their range because of loss of wetland habitats and the introduction of pesticides into watersheds (Zeiner et al. 1990a). Grebes also are vulnerable to human encroachment and disturbance at nesting colonies, and injury or death from human trash (e.g., fishing line and plastic six-pack holders).

Clark's grebe (*Aechmophorus clarkii*) has been distinguished as a separate species from western grebe (American Ornithologist's Union 1999). It is less common in southern California, although its numbers are uncertain, because this species formerly was included in counts of western grebes. Approximately 500 Clark's grebes occur as migrants and year-round residents at the Salton Sea (IID 1994). Clark's grebe uses the same foraging and nesting habitats as western grebe and faces the same threats.

Members of the ***plunge diver guild*** search for fish while flying, then dive to just below the surface to capture their prey. The plunge diving guild includes California brown pelican (*Pelecanus occidentalis californicus*), osprey (*Pandion haliaetus*), and tern species. The brown pelican is described as a special status species in Section 3.7.3.

Caspian tern (*Sterna caspia*) is a common summer resident and migrant at the Salton Sea, nesting sporadically (US Fish and Wildlife Service 1993). A population of about 500 individuals has been recorded at the Salton Sea (IID 1994). Caspian terns nest in dense colonies on undisturbed islands or shorelines.

Forster's tern (*Sterna forsteri*) is a common summer visitor and migrant and is an uncommon winter visitor at the Salton Sea (US Fish and Wildlife Service 1993). This species' population at the Salton Sea is estimated at 5,000 individuals, although nesting birds are far fewer (about 200 pairs) (IID 1994; Zeiner et al. 1990a). Forster's terns primarily plunge dive for small fish in the sea but also forage for aquatic and terrestrial invertebrates in adjacent habitats.

The ***surface feeder guild*** includes such birds as the American white pelican (*Pelecanus erythrorhynchos*) that swim or float on the surface of the water and submerge their heads to catch fish near the surface. This guild also includes the black skimmer (*Rhynops niger*), which flies low over the water scooping up aquatic invertebrates and small fish from the surface. These species are described in Section 3.7.3.

The ***predator guild*** is represented by raptors that hunt over the waters of the Sea, such as American peregrine falcon (*Falco peregrinus anatum*), or along shorelines and adjacent wetlands, such as northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), and Cooper's hawk (*A. cooperii*). These species are described in Section 3.7.3.

Ground gleaners pick up mostly invertebrates and some seeds from the sand and other shoreline substrates along the Sea. This guild also scavenges for dead aquatic organisms along the shoreline. Typical ground gleaners are cattle egrets (*Bubulcus ibis*), plovers, black-crowned heron, and horned lark.

Black-crowned night heron (*Nycticorax nycticorax*) is a common year-round breeding resident and migrant at the Salton Sea with an estimated population of 4,000 individuals (US Fish and Wildlife Service 1993; IID 1994). It feeds at night in shallow water along the edges of fresh and saline emergent wetlands, searching for fish, invertebrates, and small vertebrates. Black-crowned night heron nest and roost in trees with thick concealing foliage or in dense emergent wetlands. Although still fairly common, black-crowned night heron is considered sensitive because its known breeding colonies are vulnerable to human disturbance (Zeiner et al. 1990a). Loss of riparian and wetland habitats, environmental contaminants, and introduced predators pose additional threats to this species.

The California horned lark (*Eremophila alpestris actia*) is a resident of grasslands, deserts, and other open habitats, such as agricultural fields, beaches, and disturbed areas. At the Salton Sea, the lark is an uncommon year-round breeding resident whose population is substantially augmented during winter and fall by winter visitors (US Fish and Wildlife

Service 1993; Zeiner et al. 1990a). Horned lark forages for insects and other invertebrates on the ground, where it also nests. This species forms large flocks during the nonbreeding season.

Hawkers capture insects while in flight, often taking short flights from a perch or hovering. Examples in this foraging guild include gull-billed tern (*Sterna nilotica*), swifts, and common tern (*S. hirundo*).

Vaux's swift (*Chaetura vauxi*) is a summer resident of northern California and breeds fairly commonly in the Coast Ranges, the Sierra Nevada, and possibly the Cascade Range (Zeiner et al. 1990a). This species is a common spring migrant at the Salton Sea, where thousands of migrating birds have been documented at the north end; but the species is relatively uncommon elsewhere in the Salton Basin (Garrett and Dunn 1981). Vaux's swifts nest in tall snags or fire-charred trees (especially conifers) and often prefer to forage over water (Zeiner et al. 1990a). This species winters in Mexico and Central America, with small numbers of birds irregularly wintering in the coastal lowlands of southern California.

The ***generalist*** foraging guild includes gull species, American coots (*Fulica americana*), common moorhen (*Gallinula chloropus*), and other species that use a wide variety of food sources and employ various foraging techniques on shore and in the water.

California gull (*Larus californicus*) is a common visitor to the Salton Sea most of the year, except for the winter when it is uncommon (US Fish and Wildlife Service 1993). It scavenges for dead fish and debris along shorelines and hunts for terrestrial invertebrates, fish, and small vertebrates at the sea and in adjacent aquatic and agricultural habitats. This species is considered sensitive in California at its nesting colonies at Mono Lake and across the northeastern plateau region (Zeiner et al. 1990a; CDFG 1992).

3.7.3 Special Status Species

Table 3.7-1 lists special status species that have been identified in the Salton Sea study area. A description of most of the species listed and their distribution at the Salton Sea Basin is given below. Table 3.7-2 describes the occurrence by season in the Salton Sea Basin and whether or not they are breeding in the basin.

California brown pelican (*Pelecanus occidentalis californicus*) is found primarily in estuarine, marine subtidal, and open waters. Nesting colonies are found on the Channel Islands, the Coronado Islands, and on islands in the Gulf of California (Garrett and Dunn 1981). The brown pelican nesting colony closest to the Salton

Table 3.7-1
Special Status Bird Species

Scientific Name	Common Name	Federal*	State*	Other*

Accipiter cooperii	Cooper's hawk			CDFG: SC
A. striatus	Sharp-shinned hawk			CDFG: SC
A. gentilis	Northern goshawk	Species of Concern		
Agelaius tricolor	Tri-colored blackbird	Species of Concern		CDFG: SC
Aquila chrysaetos	Golden eagle			CDFG: SC
Asio flammeus	Short-eared owl			CDFG: SC
A. otus	Long-eared owl			CDFG: SC
Athene cunicularia	Burrowing owl	Species of Concern		CDFG: SC
Branta canadensis leucopareia	Aleutian Canada goose	Threatened		
Buteo regalis	Ferruginous hawk	Species of Concern		CDFG: SC
B. swainsoni	Swainson's hawk		Threatened	
Charadrius alexandrinus nivosus	Western snowy plover	Threatened		CDFG: SC
C. montanus	Mountain plover	Potentially Threatened		CDFG: SC
Childonias niger	Black tern	Species of Concern		
Circus cyaneus	Northern harrier			CDFG: SC
Coccyzus americanus occidentalis	Western yellow-billed cuckoo		Endangered	
Colaptes chrysoides	Gilded flicker		Endangered	
Contopus cooperi	Olive-sided flycatcher	Species of Concern		
Dendrocygna bicolor	Fulvous whistling-duck	Species of Concern		CDFG: SC
Dendroica petechia	Yellow warbler			CDFG: SC
D. petechia brewsteri	California yellow warbler			CDFG: SC
Egretta rufescens	Reddish egret	Species of Concern		
Empidonax traillii brewsteri	Little willow flycatcher	Species of Concern	Endangered	
E. traillii extimus	Southwest willow flycatcher	Endangered	Endangered	
Falco columbarius	Merlin			CDFG: SC
F. mexicanus	Prairie falcon			CDFG: SC
Grus canadensis tabida	Greater sandhill crane		Threatened	
Haliaeetus leucocephalus	Bald eagle	Threatened	Endangered	
Icteria virens	Yellow-breasted chat			CDFG: SC
Ixobrychus exilis	Least bittern	Species of Concern		CDFG: SC
Lanius ludovicianus	Loggerhead Shrike	Species of Concern		
Larus atricilla	Laughing gull			CDFG: SC
Laterallus jamaicensis coturniculus	California black rail	Species of Concern	Threatened	
Melanerpes uropygialis	Gila woodpecker		Endangered	
Micrathene whitneyi	Elf owl		Endangered	
Mycteria americana	Wood stork			CDFG: SC
Myiarchus tyrannulus	Brown-crested flycatcher			CDFG: SC

Table 3.7-1
Special Status Bird Species *(continued)*

Scientific Name	Common Name	Federal*	State*	Other*
Pandion haliaetus	Osprey			CDFG: SC
Parabuteo unicinctus	Harris' hawk			CDFG: SC
Passerculus sandwichensis rostratus	Large-billed savannah sparrow	Species of Concern		
Pelicanus erythrorhynchos	American white pelican			CDFG: SC
P. occidentalis	Brown pelican	Endangered	Endangered	
Phalacrocorax auritus	Double-crested cormorant			CDFG: SC
Plegadis chihi	White-faced ibis	Species of Concern		CDFG: SC
Piranga flava	Hepatic tanager			CDFG: SC
P. rubra	Summer tanager			CDFG: SC
Progne subis	Purple martin			CDFG: SC
Pyrocephalus rubinus	Vermilion flycatcher			CDFG: SC
Rallus longirostris yumanensis	Yuma clapper rail	Endangered	Threatened	
Riparia riparia	Bank swallow		Threatened	
Rynchops niger	Black skimmer			CDFG: SC
Sterna antillarum browni	California least tern	Endangered	Endangered	
S. elegans	Elegant tern	Species of Concern		
S. nilotica vanrossemi	Van Rossem's gull-billed tern	Species of Concern		CDFG: SC
Toxostoma bendirei	Bendire's thrasher			CDFG: SC
T. lecontei	Leconte's thrasher			CDFG: SC
Vireo bellii pusillus	Least Bell's vireo	Endangered	Endangered	
V. vicinior	Gray vireo			CDFG: SC

Sources: California Department of Fish and Game 1999. US Fish and Wildlife Service 1999.

* Federal and State Status have legal consequence. CDFG:SC (California Department of Fish and Game, Species of Concern) are assigned for information only.

Table 3.7-2
Occurrence of Special Status Birds Within the Salton Sea Basin

Species	Season of Occurrence				
Common Name	**Spring**	**Summer**	**Fall**	**Winter**	**Nesting**
Cooper's hawk	X	X	X	X	X
Sharp-shinned hawk			X	X	
Northern goshawk				X	
Tricolored blackbird	X	X	X	X	X
Golden eagle	X	X	X	X	X
Short-eared owl				X	
Long-eared owl	X	X	X	X	X
Burrowing owl	X	X	X	X	X
Aleutian Canada goose				X	
Ferruginous hawk				X	
Swainson's hawk	X				
Western snowy plover	X	X	X		X
Mountain plover				X	
Black tern	X	X	X	X	X
Northern harrier	X	X	X	X	X
Western yellow-billed cuckoo	X				
Gilded flicker	X	X	X	X	X
Olive-sided flycatcher	X	X	X		
Fulvous whistling-duck	X				
Yellow warbler	X	X	X		
California yellow warbler	X	X	X		
Reddish egret		X	X		
Little willow flycatcher	X	X	X		X
Southwest willow flycatcher	X	X	X		
Merlin			X	X	
Prairie falcon	X	X	X	X	X
Greater sandhill crane				X	
Bald eagle				X	
Yellow-breasted chat	X	X	X		X
Least bittern	X	X	X	X	X
Loggerhead Shrike	X	X	X	X	X
Laughing gull		X			
California black rail	X	X	X	X	X
Gila woodpecker	X	X	X	X	X
Elf owl	X	X			X

Table 3.7-2
Occurrence of Special Status Birds Within the Salton Sea Basin *(continued)*

Species	Season of Occurrence				
Common Name	**Spring**	**Summer**	**Fall**	**Winter**	**Nesting**
Wood stork				X	
Brown-crested flycatcher	X	X			X
Osprey	X		X		
Harris' hawk			X	X	
Large-billed savannah sparrow	X	X	X	X	X
American white pelican	X		X	X	X
Brown pelican	X	X	X	X	X
Double-crested cormorant	X	X	X	X	X
White-faced ibis	X	X	X	X	X
Hepatic tanager	X	X			
Summer tanager	X	X			
Purple martin	X	X	X	X	X
Vermilion flycatcher	X				
Yuma clapper rail	X	X	X	X	X
Bank swallow	X	X	X		X
Black skimmer	X	X	X		X
California least tern	X	X	X	X	X
Elegant tern	X	X	X	X	X
Van Rossem's gull-billed tern	X	X	X		X
Bendire's thrasher		X			
LeConte's thrasher	X	X	X	X	X
Least Bell's vireo	X	X	X		X
Gray vireo	X	X			

Sea is about 220 miles away, on San Luis Island in the Gulf of California (IID 1994). Historically, there was little use of the Salton Sea by brown pelicans, which were first confirmed overwintering at the Sea in 1987, with some visiting postbreeding pelicans documented in the late 1970s. The Salton Sea currently supports a year-round population of California brown Pelicans, sometimes reaching 5,000 birds. The brown pelican nested successfully at the Sea in 1996 and has attempted to nest since then (US Fish and Wildlife Service 1999). Brown pelicans are plunge divers, often locating fish from the air and diving into the water to catch them. They typically congregate at selected roosting locations that are isolated from human activity. The brown pelican population declined sharply in California in the 1960s due to the introduction of pesticides, such as 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-ethane (DDE), into the food chain (Zeiner et al. 1990a). The Salton Sea area has shown significant levels of DDE contamination, which can affect the brown pelican's reproductive success when they forage at the Salton Sea, even though they breed elsewhere during the winter (US Fish and Wildlife Service 1996). Approximately 1,400 brown pelicans died from avian botulism in 1996, the largest die-offs to date of pelicans in the US (Rocke 1999).

As many as 33,000 American white pelicans (*Pelecanus erythrorhynchos*) have been counted at the Salton Sea during migration and during the winter (US Fish and Wildlife Service 1999). White pelicans are surface feeders, floating or swimming on the water and scooping up fish near the surface and sometimes cooperatively hunting in groups (Zeiner et al. 1990a). From the early 1900s to the late 1950s this species nested at the Salton Sea. Currently, it is unlikely that there is sufficient undisturbed habitat at the Salton Sea to support nesting colonies of American white pelicans. Nesting American white pelicans have declined in California in the last century because of degradation and loss of nesting habitat and the only remaining nesting colonies are at large lakes in the Klamath Basin. The white pelican population is vulnerable to decline because of its low annual reproductive output, colonial nesting, and dependence on isolated nesting sites. Drought, water diversion projects, and disruptive human activities at nesting colonies have adversely affected this species. Lowering water levels in lakes allows predators to destroy nesting colonies as nesting islands become connected to mainland shorelines. American white pelicans also are susceptible to persistent pesticides that pollute the watershed. An estimated 10% of the white pelican western population died from avian botulism in 1996 (Rocke 1999).

Double-crested cormorants (*Phalacrocorax auritus*) occur as a common year-round resident at the Salton Sea, with counts of up to 10,000 individuals (US Fish and Wildlife Service 1993; IID 1994). Small numbers of cormorants have nested at the Sea in the past, and small nesting colonies were documented at the north end of the Sea for the first time in 1995 (US Fish and Wildlife Service 1996). Over 7,000 double-crested cormorants and 4,500 nests were counted on Mullet Island in 1999, the largest breeding colony on the West Coast (Point Reyes Bird Observatory 1999). Cormorants dive under the surface of the water to varying depths to capture fish and feed in the open waters of the Salton Sea. They roost on dead trees, exposed rocks, and islands. Cormorants require undisturbed sites near the water for nesting. Double-crested cormorants throughout California have been compromised recently by loss of marsh nesting habitat, pesticides in the watershed, nest predation by gulls and crows, and human disturbance and egg collection activities at nesting colonies (Zeiner et al. 1990a). 1,957 double-crested cormorants, 1,500 of which were juveniles, died in 1997 part of a larger bird die-off that killed 6,845 birds. The juvenile cormorants died from Newcastle Disease (US Fish and Wildlife Service/National Wildlife Refuge 1997-1998; Rocke 1999). Double-crested cormorants have nested successfully on Mullet Island at the Salton Sea.

Reddish egret (*Dichromanassa rufescens*) is a casual visitor in the summer and fall. It has occurred at the Salton Sea and Colorado River, but most records in California are from coastal southern California.

Least bittern (*Ixobrychus exilis hesperis*) inhabits fresh and brackish water marshes, usually near open water sources, and desert riparian habitats (Zeiner et al. 1990a). Most of the California population winters in Mexico and migrates in the spring and the summer to scattered locations in the western US, including the Colorado River, Salton Sea, Central Valley, and coastal lowlands of southern California. At the Salton Sea, the least bittern population is estimated at about 550 individuals (IID 1994). This species nests in wetlands adjacent to the Sea that provide dense emergent vegetation, such as cattails or tules. Least bittern forage for fish, aquatic and terrestrial invertebrates, and small vertebrates in shallow waters and mudflats along the Salton Sea shoreline or in adjacent freshwater marshes. The primary threats to the species are marsh drainage, human disturbance, and pesticides (Zeiner et al. 1990a).

White-faced ibis (*Plegadus chihi*) is an uncommon summer resident to areas of southern California but is more widespread during migration (Zeiner et al. 1990a). At the Salton Sea this species is a year-round resident and nests in the area in small numbers (US Fish and Wildlife Service 1996). The Salton Sea provides habitat for the second largest wintering population of this species in California; in the winter there can be as many as 16,000 white-faced ibis at the Salton Sea (US Fish and Wildlife Service 1999) and over 24,000 were recorded in 1999 (Point Reyes Bird Observatory 1999). White-faced ibis probe for invertebrates and small vertebrates in freshwater marshes, in shallow waters along lakeshores, in wet agricultural fields and meadows, and occasionally in salt marshes. This species nests in extensive marshes amidst dense, tall marsh plants. White-faced ibis has declined in California, where breeding is very limited. Destruction of large marshes is attributed as the primary reason for decline, with persistent pesticides a secondary cause (Zeiner et al. 1990a).

Wood stork (*Mycteria americana*) is a common postbreeding visitor to the Salton Sea, with up to 275 individuals counted (US Fish and Wildlife Service 1993; IID 1994). Wood storks breed in Florida and Mexico but visit the Salton Sea to forage in wetlands and fields during the summer. This species primarily forages in shallow water for fish, small vertebrates, and aquatic invertebrates. The decline of this species is attributed to loss of breeding and foraging habitat in Florida.

Fulvous whistling-duck (*Dendrocygna bicolor*) historically occurred as a regular summer visitor in small numbers along the southern California coast north to Los Angeles and in greater numbers in the Central Valley (Garrett and Dunn 1981). This species no longer breeds in these areas. It also has declined along the Colorado River and at the Salton Sea and is now considered a rare summer visitor that may sporadically breed at the Salton Sea (US Fish and Wildlife Service 1993). The Salton Sea supports a population of about 200 individuals during the spring and summer, with a much smaller breeding population (IID 1994). Fulvous whistling-duck nest in dense freshwater wetlands near the south end of the Salton Sea and forage on wetland plants and submerged aquatic vegetation in freshwater habitats. Reasons for decline of the fulvous whistling-duck are draining and development of marsh habitats and hunting. Pesticides have been shown to cause declines in Fulvous whistling- duck populations in other states and also may have adversely affected the California population (Zwank et al. 1988).

Ospreys (*Pandion haliaetus*) nest in northern California, and small numbers winter in southern California, with most of the population wintering in Central America and South America (Zeiner et al. 1990). At the Salton Sea, ospreys occur in small numbers as a nonbreeding visitor throughout the year (US Fish and Wildlife Service 1993). Ospreys are plunge divers, searching for fish from the air or from perches and, as a result, require clear open water to locate prey. Upon locating fish, ospreys dive to capture the fish, using their talons, near the surface of the water. This species uses large trees or snags near the water for roosting and hunting. Heavy logging has destroyed fisheries and nest sites, adversely affecting the osprey population in California (Zeiner et al. 1990a). Human disturbance and pesticides also have contributed to the decline of this species.

Southern bald eagle (*Haliaeetus leucocephalus leucocephalus*) is the subspecies of bald eagle found in California and it is the largest raptor in California. Although not nesting in the Salton Sea area, it is an occasional winter visitor and feeds on dead tilapia along the shoreline. Trees in the area provide important habitat for roosting.

Northern harrier (*Circus cyaneus hudsonius*) is a widespread winter resident and migrant in suitable habitat in California, although it has declined as a breeding species (Zeiner et al. 1990a). At the Salton Sea, this species is a common winter visitor (US Fish and Wildlife Service 1993). Harriers forage for small mammals, birds, and other small vertebrates along the shore of the Sea and in adjacent natural habitats and agricultural fields. This species has declined substantially in California in the last century because of loss of wetland nesting habitat and perennial grassland foraging habitat. Northern harrier nest on the ground and are vulnerable to nest destruction from agricultural and other human activities, nest predation, and heavy grazing, which reduces nesting cover and also can result in trampling of nests (Zeiner et al. 1990a). Reduced reproductive success has resulted from eggshell thinning caused by accumulated organochlorines and also has contributed to the decline of this species.

Sharp-shinned hawk (*Accipiter striatus*) is a fairly common migrant and winter resident in California, although its breeding distribution is poorly documented (Zeiner et al. 1990a). At the Salton Sea it is an uncommon winter visitor (US Fish and Wildlife Service 1993). Sharp-shinned hawks feed primarily on small birds in riparian and scrub habitats adjacent to the Sea.

Cooper's hawk (*A. cooperii*) is a breeding resident in wooded portions of the state, often nesting in deciduous trees near riparian areas and in oak and coniferous woodlands (Zeiner et al. 1990a). It occurs as an uncommon winter visitor to the Salton Sea (US Fish and Wildlife Service 1993). Cooper's hawk relies mainly on avian prey, which it hunts in riparian and shrubland habitats near the Sea. Cooper's hawk has declined as a breeding species in California because of pesticide-caused reproductive failure in the

1950s and 1960s, habitat loss and fragmentation, illegal shooting, and human encroachment and disturbance in nesting areas (Remsen 1978).

Northern goshawk (*A. gentilis*) feeds on ground-dwelling birds and ducks. Eggshell thinning in this species was reported from some areas in the early 1970s. Like Cooper's hawk, the northern goshawk is an uncommon winter visitor to the Salton Sea.

Swainson's hawk (*Buteo swainsoni*) occurs throughout much of the western half of the continent. It inhabits the open desert and agricultural areas of the Salton Sea and preys on small vertebrates and insects, some reptiles, and fledgling birds. Expanding agricultural lands has increased its breeding opportunities.

Breeding ferruginous hawk (*B. regalis*) is distributed throughout the Great Basin and Great Plains of the western United States and southern Canada (Johnsgard 1988). The winter range is expanded south to Mexico, west to California, and east to Texas. In California this species is distributed throughout southern California, the Central Valley, the deserts, the coast range, and the northeast corner of the state (Zeiner et al. 1990a). Ferruginous hawks in California occur in large expanses of grassland, agricultural, sagebrush flat, desert scrub, and pinyon-juniper habitats (Zeiner et al. 1990a). This hawk is a rare winter visitor to the Salton Sea (US Fish and Wildlife Service 1993).

In California, prairie falcons (*F. mexicanus*) inhabit open grassland, desert, and agricultural habitats away from the coast, and they nest in cliffs overlooking open areas (Zeiner et al. 1990a). Prairie falcons are rare migrants (about 30 migrants annually) at the Salton Sea and in the Imperial Valley (US Fish and Wildlife Service 1993). Prairie falcons forage for avian and mammalian prey in open desert and grassland habitats surrounding the Salton Sea, as well as along the shores of the Sea. Prairie falcon declines in California are attributed to loss of foraging habitat, human disturbance at nest sites, rodent control programs that decrease the falcon's prey base (e.g., ground squirrels), and potential reproductive impacts from pesticides (Remsen 1978).

California black rail (*Laterallus jamaicensis*) occurs as a scarce yearlong resident in the San Francisco Bay Area, Sacramento-San Joaquin Delta, a few locations along the coast of California, the Salton Sea, and lower Colorado River (Zeiner et al. 1990a). This species inhabits saline, freshwater, and brackish water marshes. The California black rail's decline throughout its range is attributed to the loss of saltwater and freshwater wetlands to urban and agricultural development (Wilbur 1974). It hides its nest in dense wetland vegetation and forages for insects from the surface of mud and vegetation (Zeiner et al. 1990a). At the Salton Sea this species has been reported at a number of locations, including Finney Lake, near Seeley, near Niland, Calipatria, Salt Creek, and seepage areas associated with the Coachella and All American canals (Garrett and Dunn 1981). The status of this species is uncertain at the Salton Sea, with some locations having numerous calling birds over periods of several weeks in the spring, which suggests a breeding population.

Yuma clapper rail (*Rallus longirostris yumanensis*) is a rare, year-round resident at the Salton Sea and along the lower Colorado River into Mexico (US Fish and Wildlife Service 1993; Zeiner et al. 1990a). Since 1990 and average of 365 rails have been counted around the Sea which represents an estimated 40 percent of the entire US population of this species (Point Reyes Bird Observatory 1999; US Fish and Wildlife Service 1999). Yuma clapper rails occur at the south end of the Salton Sea near the New and Alamo river mouths, at the Salton Sea Wildlife Refuge, at the Wister Waterfowl Management Area, the Imperial Wildlife Area, and other locations. A population of 400 rails has been documented from the Salton Sea area (IID 1994). This rail probes in freshwater and saltwater emergent wetlands for aquatic and terrestrial invertebrates and occasionally for small fish. Nests are built in emergent vegetation. Yuma clapper rails have declined because of loss of marsh habitat. Actions to preserve and increase the freshwater marsh habitat are critical to the recovery of this species (US Fish and Wildlife Service 1999).

Sandhill cranes (*Grus canadensis tabida*) are uncommon winter migrants at the Salton Sea, with fewer than 300 in the Imperial Valley (US Fish and Wildlife Service 1993; IID 1994). Both the greater and lesser subspecies have been detected, with most observations being of the greater subspecies. This species probes for a variety of invertebrates, small vertebrates, plants, and seeds in agricultural fields near the Salton Sea.

Western snowy plover (*Charadrius alexandrinus nivosus*) occurs along the Pacific Coast, from southern Washington to Baja California. Western snowy plover are year-round breeding residents and summer migrants at the Salton Sea, with a summer population of over 200 individuals (US Fish and Wildlife Service 1993; IID 1994). The Salton Sea supports the greatest number of western snowy plovers in the interior of California (US Fish and Wildlife Service 1999). Snowy plovers nest on undisturbed, flat, sandy or gravelly beaches at the Salton Sea. They glean food from the wet sand at the beach-water interface, feeding on terrestrial and aquatic invertebrates. The species is declining because of increased human disturbance, loss of feeding and nesting areas, and increased predation by birds and mammals.

Mountain plover (*C. montanus*) is a fairly common winter visitor to the Salton Sea Basin. The Imperial Valley has one of the mountain plover's largest wintering populations in the Pacific Flyway, with between 700 and 1,000 individuals (US Fish and Wildlife Service 1999). During February 1999 surveys 2,486 individuals were counted which represents approximately half of the California population (Point Reyes Bird Observatory 1999). This species gleans terrestrial invertebrates from the ground and is found in agricultural fields and pastures near the Salton Sea. Mountain plovers have declined principally because of loss of nesting habitat.

Laughing gull (*Larus atricailla*) is a common post-breeding visitor (up to 1,000 individuals) at the Salton Sea and previously nested in the area (US Fish and Wildlife Service 1993; IID 1994). Most laughing gulls occur at the south end of the Sea and adjacent habitats, where they scavenge for food along shorelines and forage for invertebrates and fish.

Van Rossem's gull-billed tern (*Sterna nilotica vanrossemi*) is an uncommon summer breeding resident at the Salton Sea with a population of 300 (US Fish and Wildlife Service 1993; IID 1994). The only other nesting location in California is at San Diego Bay, which has a small colony. This species nests on open sandy flats often near the colonies of other terns (Zeiner et al. 1990a). Gull-billed terns hawk for insects over beaches and mudflats at the Salton Sea and in adjacent wetlands and agricultural fields. They also forage to a lesser degree for aquatic invertebrates, small vertebrates, fish, and bird eggs. This species was nearly exterminated in the early 1900s because of egg and feather collection (Zeiner et al. 1990a). Numbers of nesting birds at the Salton Sea have declined because of rising Sea elevation flooded nests.

Elegant tern's (*S. elegans*) range in North America is extremely limited, and it occurs in a few places in California, two of them being the Salton Sea and San Diego Bay. The elegant tern inhabits salt marsh dikes, sand beaches, and flats. It forages for fish by plunge diving from high altitudes into the water (Erlich et al. 1988; Scott 1987).

California least tern (*S. antillarum browni*) nests in open sand, salt pans, or dried mudflats near lagoons or estuaries. It is an occasional visitor to the Salton Sea, where its activity is likely limited to foraging in the open water and resting on the shore (US Fish and Wildlife Service 1999). California least terns may be susceptible to the effects of pesticide contamination and bioaccumulation (Boardman 1987a and 1987b).

Black tern (*Childonias niger*) inhabits freshwater marshes, sloughs, lakeshores, and wet meadows. It is declining in many areas because of a loss of wetland habitat. The Salton Sea watershed is thought to be the most important staging area for black terns in the Pacific Flyway (US Fish and Wildlife Service 1999). The black tern forages for insects by hawking and also takes aquatic invertebrates and fish (Ehrlich et al. 1988).

Black skimmer (*Rynchops niger*) is an uncommon summer breeding resident at the Salton Sea, with a population of 600 individuals (US Fish and Wildlife Service 1993; IID 1994). Skimmers prefer to build nesting colonies on gravel bars, low islands, and sandy beaches (Zeiner et al. 1990a). This species forages by skimming low over the surface of the water, scooping up fish and aquatic invertebrates. At the Salton Sea, black skimmers forage over open water and along beaches and mudflats. Skimmers are sensitive because of their extremely limited nesting distribution and abundance in California. Nesting colonies are located only at the Salton Sea, San Diego Bay, and the Bolsa Chica Refuge in Orange County. This species also is losing nesting sites because of rising water levels at the Salton Sea and because of human disturbance at beaches.

The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) once nested from Mexico to southern British Columbia. In California remnant populations breed along sections of seven rivers, including the Colorado River in the southern part of the state. The yellow-billed cuckoo suffered from wholesale destruction of riparian habitat in

California over the last 100 years. Although the yellow-billed cuckoo has not been seen recently in the Salton Sea area, suitable habitat does exist in some of the upper reaches of streams draining into the Sea, such as Whitewater River.

The breeding range of the North American subspecies of burrowing owl (*Athene cunicularia*) extends south from southern Canada into the western half of the United States and down into Baja California and central Mexico (Johnsgard 1988). This species is a common year-round resident adjacent to the Salton Sea and in the surrounding Imperial Valley (Garrett and Dunn 1981; US Fish and Wildlife Service 1993). Their density in Imperial County surpasses that in any other single county in California (Sturm 1999). Burrowing owls inhabit open areas, such as grasslands, pastures, coastal dunes, desert scrub, and the edges of agriculture fields. At the Salton Sea, burrowing owls are concentrated along the edges of agricultural fields, especially where the banks of irrigation ditches provide suitable nesting burrows. There are fewer owls inhabiting areas of open desert scrub (Garrett and Dunn 1981). Burrowing owls have declined through much of their range because of habitat loss due to urbanization and agricultural conversion (Remsen 1978). The incidental poisoning of burrowing owls and the destruction of their burrows during eradication programs aimed at rodent colonies also has been a large factor in their decrease (Collins 1979; Remsen 1978).

The normal range of the short-eared owl (*A. flammeus*) extends from the central United States to Alaska, although occasional nesting has been reported as far south as central Mexico and Cuba (Johnsgard 1988). Short-eared owls are rare winter visitors to the Salton Sea area (US Fish and Wildlife Service 1993; Garrett and Dunn 1981). The species typically nests in well-vegetated open areas, including grasslands, grain fields, riparian edges, and marshes. Many populations of short-eared owls are migratory, and juveniles have been recorded dispersing over great distances (Johnsgard 1988).

The elf owl (*Micrathene whitneyi*) breeds in arid regions of southeastern California along the Colorado River riparian corridor, from just north of Needles to near Palo Verde in Imperial County. Owls also have been sighted at Corn Springs near Desert Center in Riverside County.

The range of the loggerhead shrike (*Lanius ludovicianus*) encompasses most of the lower 48 states and an area extending northward from Montana and North Dakota into Canada. It the Salton Sea it inhabits open farmland and urban areas with trees. The loggerhead shrike is found year around in the Salton Sea area and is uncommon, though can be found with a little searching. The shrike nests in the area. Its diet consists of mostly large insects, and small vertebrates including small birds, mice and lizards. Due to habitat loss and pesticides, the loggerhead shrike's populations are declining everywhere especially in the United States (Ehrlich et al. 1988; Scott 1987).

In California, gila woodpeckers (*Melanerpes uropygialis*) are distributed along the lower Colorado River and occur locally near Brawley in the Imperial Valley (Zeiner et al. 1990a). This species typically occurs in desert riparian and desert wash habitats but also is found in orchard-vineyard and residential habitats. Near Brawley it depends on trees in date palm groves and ranch yards (Garrett and Dunn 1981). It formerly was common in the Imperial Valley and was recorded as far north as Coachella Valley at the north end of the Salton Sea. The decline of this species may be attributed to the clearing of riparian woodlands and to competition with introduced European starlings for nesting cavities (Remsen 1978). Gila woodpeckers eat insects, berries, and cactus fruits, and they nest in cavities of saguaro cacti or riparian trees.

Southwestern willow flycatcher (*Empidonax traillii extimus*) is a summer breeding resident in riparian habitats in southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, southwestern Colorado, and northwestern Mexico (US Fish and Wildlife Service 1999). The largest breeding populations of southwestern willow flycatcher in California occur along the San Luis Rey and Santa Margarita rivers in San Diego County and along the south fork of the Kern River at the southwest end of the Sierra Nevada Mountains. This subspecies is restricted to dense riparian woodlands of willow, cottonwood, and other deciduous shrubs and trees. Egg laying occurs in southern California from the end of May through the end of June. Dense willow thickets are required for nesting, and nests are often near standing water (Zeiner et al. 1990a). The southwestern willow flycatcher was listed as endangered by the US Fish and Wildlife Service in February 1995 because of "extensive loss of riparian breeding habitat, brood parasitism by the brown-headed cowbird *(Molothrus ater)*, and lack of adequate protective regulations". This subspecies previously was listed as endangered by the California Department of Fish and Game in December 1990. The population of southwestern willow flycatcher in southern California was estimated to be fewer than 80 pairs in the early 1980s (Unitt 1984).

Large numbers of willow flycatcher pass through southern California deserts during spring and fall migration (Garrett and Dunn 1981). It is difficult to differentiate between the endangered subspecies that breeds in southern California and the nonendangered subspecies *(E. t. brewsteri)* that breeds to the north in the Sierra Nevada and Cascade mountain ranges. There is a period of overlapping occurrence in southern California riparian habitats for these two very similar looking subspecies during spring and fall migration. At the Salton Sea, willow flycatcher, undetermined subspecies status, is an uncommon spring migrant and common fall migrant (US Fish and Wildlife Service 1993). It occurs in residential areas and in riparian and desert scrub habitats.

Olive-sided flycatcher (*Contopus cooperi*) is a transient and summer visitor, breeding in montane and subalpine forests. They can be found throughout the state in appropriate habitat of tall trees.

Bank swallow (*Riparia riparia*) historically was considered locally common in the lowland regions of California. The species today is extirpated from much of its former range, including all known historical locations in southern California. The bank swallow migrates through the Salton Sea area in April and again in September on its way between South American and its remaining nesting areas in northern California.

Yellow warbler (*Dendroica petechia*) is a summer visitor that nests only in mature riparian woodland when in California. It is a common spring and fall migrant and a rare winter visitor to the Salton Sea area (US Fish and Wildlife Service 1993). Yellow warbler has declined considerably in the coastal lowlands and may be extirpated as a breeding visitor from the Colorado River (Garrett and Dunn 1981). Decline of the yellow warbler is attributed to loss of riparian nesting habitat and nest parasitism by the brown-headed cowbird.

Yellow-breasted chat (*Icteria virens auricollis*) is an uncommon summer resident and migrant in coastal California and in the foothills of the Sierra Nevada Mountains (Zeiner et al. 1990a). At the Salton Sea, yellow-breasted chats are occasional migrants and breeding summer visitors to riparian habitats (US Fish and Wildlife Service 1993). Yellow-breasted chat is restricted to nesting in riparian woodland, where it frequents dense undergrowth. The decline of this species in California can be attributed to the loss and degradation of riparian habitats and to nest parasitism by the brown-headed cowbird (Zeiner et al. 1990a).

Least Bell's vireo (*Vireo belli pusillus*) migrate from their wintering ground in southern Baja California to southern California between mid-March and early April to southern California, where they remain until July or August. They inhabit meandering rivers with riparian vegetation, feeding almost entirely on insects. Believed to have been historically abundant, the breeding populations north of the US-Mexico border now numbers only about 400 pairs. Least Bell's vireo currently breeds in only a few scattered areas of riparian habitat in southern California along the coast and western edge of the Mojave Desert. The spread of agriculture, excessive livestock grazing, and recreational activities continue to put pressure on the remaining population.

Tri-colored blackbird (*Agelaius tricolor*) is a resident within the state but nomadic in fall and winter. They breed in freshwater marshes of tules, cattails, bulrushes, and sedge.

In California, large-billed savannah sparrow (*Passerculus sandwichensis rostratus*) is a winter visitor to saline emergent wetlands at the Salton Sea and along the southern coast (Zeiner et al. 1990a). It breeds at the Colorado River Delta in Mexico (Garrett and Dunn 1981). This subspecies of savannah sparrow has become a rare to uncommon post breeding and winter visitor to salt cedar scrub near river mouths at the Salton Sea (Garrett and Dunn 1981). It occurs from mid-July through the winter. Large-billed savannah sparrow was once widespread in salt marshes and on beaches along the coast of southern California. Its decline may be partially caused by the drying up of marshes at the mouth of the Colorado River.

3.8 VEGETATION AND WILDLIFE

3.8.1 Introduction

The affected environment discussion for vegetation and wildlife includes plant communities, wildlife, special-status wildlife species, sensitive habitats, and sensitive plants. Animal abundance and diversity is closely linked with the habitat types present in a particular area and also depend on the season. Special status wildlife species are delineated by invertebrates, amphibians, reptiles, and mammals. The phase I study area for vegetation and wildlife is defined as parts of Imperial and Riverside counties adjacent to the Sea and associated land. Preliminary data from studies being conducted on the Salton Sea through the Salton Sea Science Subcommittee has been included in this section and Section 4.8, as applicable. Once the studies are completed, the data will be used to analyze future phases of the project.

3.8.2 Plant Communities

Vegetation in the Salton Sea region can be divided into two types: aquatic and terrestrial. Aquatic vegetation is important to aquatic species in the Salton Sea and consists of primarily nonnative species. Terrestrial vegetation is generally sparse and consists mostly of xerophytes, or plants adapted to habitats with limited water, except in areas that have a perennial source of ground water or surface water. The primary vegetation communities in the Salton Sea region are discussed below and include freshwater marsh, cismontane alkali marsh, open water and mudflat habitat, urban, agricultural land, Sonoran desert scrub, Mojavean desert scrub, chaparral, non-native grassland, alkali playa, southern riparian forest, desert dry wash woodland, and oak forest. Figure 3.8-1 shows the primary vegetation found in the Salton Trough.

Freshwater Marsh

Freshwater marsh consists of scattered stands dominated by weedy nonnative species, such as common reed (*Phragmites australis*), cattail (*Typha* sp.), golden dock (*Rumex maritimus*), and rabbitfoot grass (*Polypogon monspeliensis*). Freshwater marsh is limited primarily to linear stands along unlined drainage canals and appears to have developed as a result of agricultural irrigation. Extensive freshwater marsh areas are found on the adjacent Imperial Waterfowl Management Area, Sonny Bono Salton Sea National Wildlife Refuge, and private hunting clubs around the Sea. These support large numbers of waterfowl and a variety of sensitive species, particularly Yuma clapper rail and black rail. The freshwater wetlands (Figure 3.8-2) are further divided as shoreline strand, adjacent wetlands, managed wetland and riparian wetland. The shoreline strand is found immediately adjacent to the Sea and is composed of predominantly salt-tolerant species such as iodine bush and tamarisk. There are approximately 348 acres of shoreline strand. Adjacent wetlands are those above the shoreline and shoreline strand and include mudflats, diked wetlands that are below the Sea level and are sustained by a combination of seepage from the Sea and agricultural drainage and total 7,393 acres. Managed wetlands can be found on California Department of Fish and Game and US Fish and Wildlife refuges. Managed wetlands can also be found duck clubs and aquaculture ponds along the southern shore and near the mouth of the Whitewater River to the North. These wetlands are managed as freshwater to brackish wetlands or agricultural lands for forage crops and total 7,416 acres. The riparian wetland includes riverine plant communities along the New, Alamo and Whitewater Rivers, and wetland plant communities along the San Felipe, Salt and Thiery Creeks and totals 2,555 acres. The vegetation varies from tamarisk along the New River; cattails and bulrush along the Alamo River; to highly altered wetlands of willow and cottonwood along the Whitewater River (Kranz et al, 1999).

Cismontane Alkali Marsh

Cismontane alkali marsh in the area consists of excavated, low-lying areas supporting a dense cover of salt grass (*Distichlis spicata*), with scattered clumps of alkali bulrush (*Scirpus robustus*), cattail, common reedgrass, spreading alkali-weed (*Cressa truxillensis*), verrucose sea-purslane (*Sessuvium verrucosum*), saltmarsh sand spurrey (*Spergularia marina*), and seaside heliotrope (*Heliotropium curassavicum*), among others. Cismontane alkali marsh occurs on alkaline soils in areas with high water tables. It is found primarily in disturbed sites, such as borrow areas adjacent to dikes and along unlined drainage canals.

Open Water and Mudflat Habitats

Interspersed throughout the Salton Sea are areas of open water and mudflats. Open water habitat is differentiated from mudflats in that it is more or less permanently flooded and may support submerged or emergent vegetation. Mudflats are unvegetated areas that are periodically flooded and exposed.

Urban

Urban plant communities include developed areas (towns and cities) that contain disturbed areas and landscaping around dwellings, businesses, and parks.

Agricultural Land

Agricultural land is found extensively throughout the Imperial and Coachella valleys and consists of cultivated, irrigated, and drained land. Agriculture is one of the most important habitat components in the Salton Trough. Absent other sources of adequate flow into the Salton Sea, the continued agricultural production in the Imperial and Coachella valleys ensures not only the Salton Sea's very existence but also provides fields of abundant food resources for a variety of wildlife species (US Fish and Wildlife Service 1999). A ruderal community typically occurs along agricultural field borders, canals, drains, riverbanks, roadsides, and railroad crossings where human activities have removed natural vegetative cover. Ruderal areas are vegetated by weedy and early successional species that can survive regular disturbance. Agricultural land generally offers poor habitat, although some species forage there for agricultural pests, and a number of small mammals, songbirds, and raptors, such as burrowing owls and red tailed hawks, feed on insects and rodents attracted to crops (US Fish and Wildlife Service 1999).

Sonoran Desert Scrub

Sonoran desert scrub includes Sonoran creosote bush scrub, Sonoran desert mixed scrub, and Sonoran mixed and woody and succulent scrub. Sonoran creosote bush scrub, described as the basic creosote scrub of the Colorado Desert, is found throughout deserts of the southwest on well-drained secondary soils of slopes, fans, and valleys (Holland 1986). This community occurs on well-drained secondary soils of slopes, alluvial fans, bajadas, and lowlands and intergrades with partially stabilized desert dunes and sand fields (US Fish and Wildlife Service 1999). This community is dominated by creosote bush (*Larrea divaricata*). Other subdominant species include burro weed (*Ambrosia dumosa*), brittle brush (*Encelia farinosa*), and ocotillo (*Fouquieria* *splendens*). Ephemeral herbs flower in late February and March when winter rains are sufficient (Holland 1986).

This community type supports low numbers of mammals. Both migrating and resident bird species are known to use the mesquite (*Prosopis juliflora*) thickets in this community for feeding, resting, and roosting cover.

Mojavean Desert Scrub

Mojavean desert scrub includes Mojave desert bush scrub, Mojave mixed woody scrub, Mojave mixed steppe, and blackbush scrub within the Salton Trough. Mojave desert bush scrub is found on well-drained secondary soils with very low available water holding capacity on slopes, fans, and valleys rather than upland sites with thin, residual soils or sites with high soil salinity.

Mojave mixed woody scrub generally is found on very shallow, overly drained soils on rolling to steep slopes, usually derived from granitic parent materials. These sites have extremely low water holding capacity and mild alkalinity and are not very saline.

Mojave mixed steppe occurs on dry, sandy, or gravelly places from 2,000 to 7,000 feet in upper bajadas and lower residual slopes. It is fairly dense grassland, with several shrubby species from Mojave mixed woody scrub scattered throughout.

Blackbush scrub occurs on well-drained slopes and flats with shallow, often calcareous soils of very low water-holding capacity. Low, often intricately branched shrubs with bare ground between plants are found in blackbush scrub communities.

Chaparral

Semi-desert chaparral occurrence falls between that of northern mixed chaparral and red shank chaparral. Its growth is similar to northern mixed chaparral but is more open and not quite so tall.

Interior live oak chaparral is fairly mesic and is found in valleys and foothills away from the immediate coast, especially in lower montane coniferous forests. It forms a dense tall chaparral dominated by *Quercus corneliusmulleri* and *Q. wislizenii*, with several other sclerophylls also in the canopy and a sparse understory.

Nonnative Grassland

Nonnative grassland is generally found on fine-textured, usually clay soils that are moist or even waterlogged during the winter rainy season and very dry during the summer and fall. It forms a dense to sparse cover of annual grasses with flowering culms 0.7 to 1.6 feet high. It is often associated with numerous species of showy, flowered, native annual forbs.

Alkali Playa

Alkali playa occurs in poorly drained soils with high salinity or alkalinity due to evaporation of water that accumulates in closed drainages, often with a high water table and a salt crust on the surface. It usually is composed of low, grayish, microphyllous and succulent shrubs to up to approximately three feet tall. Total cover is usually low due to wide spacing between shrubs and minimally developed understory.

Southern Riparian Forest

Southern riparian forest includes southern arroyo willow riparian forest and southern cottonwood willow riparian forest within the Salton Trough. Southern cottonwood willow riparian forest occurs in subirrigated lands and those subject to frequent overflow from rivers and streams. The dominant species require moist, bare, mineral soil for germination and establishment. It is composed of tall, open, broadleafed, winter-deciduous riparian forests dominated by *Populus fremontii*, *P. trichocarpa*, and several tree willows. The understory is usually composed of shrubby willows.

Desert Dry Wash Woodland

Desert dry wash woodland habitat occurs in sandy/gravelly washes and arroyos of the lower Mojave and Colorado deserts. Surface sheet flows typically form braided channels that move or wander with every flow event. It forms an open to dense, drought-deciduous, microphyllous riparian thorn scrub woodland 30 to 60 feet tall, dominated by any of several trees of the pea family.

3.8.3 Wildlife

Nearly fifty species of wildlife can be found in the Salton Sea Basin. Most are resident species. High average temperatures, sparse precipitation and limited vegetation cover limit the numbers of species and populations at the Salton Sea. The highly saline conditions of the Sea itself limit its value as a water source for wildlife. Most species found are those adapted to severe desert conditions of heat, drought, and wind. Most flora is composed of annual species, and wildlife responds to the seasonal changes in the vegetation. The most consistent wildlife populations can be found associated with the more permanent vegetation found along the Salton Sea shoreline and riparian vegetation along streams and agricultural drains.

Reptiles

Over 24 species of reptiles are known to occur in the area. The side-blotched lizard (*Uta standburiana*), western whiptail (*Cnemidophorus tigris*), zebra-tailed lizard (*Callisaurus draconoides*), long-tailed brush lizard (*Urosaurus graciosus*), desert horned lizard (*Phrynosoma platyrhinos*), and desert iguana (*Dipsosaurus dorsalis*) are common and widely distributed throughout the area. The desert spiny lizard (*Sceloporus magister*) depends on the presence of large ironwoods, and lizards, including the western chuckwalla (*Sauromalus obesus*), use rocky outcrops and slopes. There are five special status reptile species found in the area, and they are described in more detail in Section 3.8.4, Special Status Species.

Mammals

Over twenty mammal species are found in the study area, the most common of which include the desert pocket mouse (*Perognathus peniciflatus*), pocket mouse (*P. longimembris*), desert kangaroo rat (*Dipodomys deserti*), Merriam's kangaroo rat (*D. merriam*), black-tail jackrabbit (*Lepus californicus*), Audubon's cottontail rabbit (*Sylvilagus audubonii*), mule deer (*Odocoileus hemionus*), and coyote (*Canis latrans*). Most mammal species are expected to occur, for the most part, in the woodland, desert riparian, and creosote bush scrub habitat where cover, food, and prey are most abundant.

3.8.4 Special Status Wildlife Species

Table 3.8-1 lists the special status wildlife species found in the Salton Sea Basin in Imperial and Riverside counties.

Table 3.8-1
Special Status Wildlife Species of Imperial and Riverside County

Species		Status		
Scientific Name	**Common Name**	**Federal***	**State***	**Other***
Invertebrates				
Lytta inseparata	Mojave desert blister beetle	Species of Concern		
Macrobaenetes valgum	Coachella giant sand treader cricket	Species of Concern		
Oliarces clara	cheeseweed moth lacewing	Species of Concern		
Pseudocotalpa andrewsi	Andrew's dune scarab beetle	Species of Concern		
Stenopelmatus cahuilaensis	Coachella Valley Jerusalem cricket	Species of Concern		
Amphibians				
Batrachoseps aridus	desert slender salamander	Endangered	Endangered	
Bufo microscaphus californicus	arroyo southwestern toad	Endangered		CDFG: SC
Rana aurora ssp. *draytoni*	California red-legged frog	Threatened		CDFG: SC
R. yavapaiensis	lowland leopard frog	Species of Concern		
Reptiles				
Anniella pulchra pulchra	silvery legless lizard	Species of Concern		CDFG: SC
Crotalus ruber ruber	Northern red-diamond rattlesnake	Species of Concern		CDFG: SC
Gopherus agassizi	desert tortoise	Threatened	Threatened	
Phrynosoma mcalli	flat-tailed horned lizard			CDFG: SC
Sauromalus obesus obesus	western chuckwalla	Species of Concern		
Uma inornata	Coachella Valley fringe-toed lizard	Threatened	Endangered	
U. notata notata	Colorado fringe-toed lizard	Species of Concern		CDFG: SC
Xantusia henshawi gracilis	sandstone night lizard	Species of Concern		CDFG: SC
Mammals				
Antrozous pallidus	pallid bat			CDFG: SC
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	Species of Concern		CDFG: SC
Choeronycteris mexicana	Mexican long-tongued bat	Species of Concern		CDFG: SC
Corynorhinus townsendii pallescens	pale western big-eared bat			CDFG: SC
Euderma maculatum	spotted bat	Species of Concern		CDFG: SC
Eumops perotis californicus	Greater western mastiff bat	Species of Concern		CDFG: SC
Felis concolor browni	Yuma puma	Species of Concern		CDFG: SC
F. onca arizonensis	jaguar	Endangered		

Table 3.8-1
Special Status Wildlife Species of Imperial and Riverside County *(continued)*

Species		Status		
Scientific Name	**Common Name**	**Federal**	**State**	**Other**
Glaucomys sabrinus californicus	San Bernardino northern flying squirrel	Species of Concern		
Macrotus californicus	California leaf-nosed bat	Species of Concern		CDFG: SC
Myotis ciliolabrum	western small-footed myotis	Species of Concern		
M. lucifugus occultus	occult little brown bat	Species of Concern		CDFG: SC
M. velifer brivis	southwestern cave myotis	Species of Concern		CDFG: SC
Nyctinomops femorosacca	pocketed free-tailed bat			CDFG: SC
N. macrotis	big free-tailed bat			CDFG: SC
Onychomys torridus ramona	southern grasshopper mouse	Species of Concern		CDFG: SC
Ovis canadensis cremnobates	peninsular bighorn sheep	Endangered	Threatened	
Perognathus longimembris bangsi	Palm Springs pocket mouse	Species of Concern		CDFG: SC
P. longimembris internationalis	Jacumba little pocket mouse	Species of Concern		CDFG: SC
Sigmodon hispidus eremicus	hispid cotton rat	Species of Concern		CDFG: SC
Spermophilus tereticaudus chlorus	Palm Springs round-tailed ground squirrel	Species of Concern		CDFG: SC

Sources: California Department of Fish and Game 1999.; US Fish and Wildlife Service 1999

* Federal and State Status have legal consequence. CDFG:SC (California Department of Fish and Game, Species of Concern) are assigned for information only.

Sensitive Invertebrate Species

Coachella giant sand treader cricket (*Macrobaenetes valgum*) is a federal sensitive species and is endemic to the Coachella Valley. Damp sand dunes are the permanent preferred habitat for this species. In very dry years, the species disappears over most of the sandy areas (Tinkham 1962). Winter rains regulate the abundance of the treader cricket. This species is likely to occur in the Salton Sea Trough.

Coachella Valley Jerusalem cricket (*Stenopelmatus cahuilaensis*) is a federal sensitive species. It has a large, round head, no wings, heavily spined hind legs, and black rings around its abdomen. Jerusalem crickets can grow to two inches, are nocturnal and live in the soil. They generally require high humidity and are most active in the spring, after the winter rains. In the dry summer months, Jerusalem crickets burrow to escape the heat. This species is likely to occur in the Salton Sea Trough.

Cheeseweed moth lacewing (*Oliarces clara*) is a federal sensitive species. Its distribution is restricted to the southern California counties of Imperial, Riverside, and San Bernardino and to Yuma County in western Arizona (US Fish and Wildlife Service 1999). This species is rarely observed in the field. Upon hatching, larvae for this species burrow into the ground and seek out the roots of a creosote bush. The cheeseweed moth lacewing is a weak flyer and therefore easy prey for birds and other insects. This species is known to occur in the Salton Sea Trough.

Andrew's dune scarab beetle (*Pseudocotalpa andrewsi*) is a federal sensitive species endemic to the creosote bush scrub habitats of the Algodones Dunes in Imperial County, California. This species inhabits both surface and subsurface sand, using the wet sand to protect it from the heat of the day. Andrew's dune scarab beetle primarily occurs at elevations between 98 and 492 feet in desert dune and Sonoran desert scrub habitats. Adults of this species generally swarm from April to mid-May. This species is known to occur in the Salton Sea Trough.

Sensitive Amphibian Species

Arroyo southwestern toad (*Bufo microscaphus californicus*) is restricted to rivers that have shallow, gravelly pools adjacent to sandy terraces. Arroyo toads historically were found along the entire drainages in southern California from San Luis Obispo to San Diego County, but are now found only in the headwaters of a few streams in small isolated populations. They have been extirpated from an estimated 75 percent of their former range in the United States. In the Salton Trough there is a population of arroyo toads near the community of Bonniebelle, north of I-10.

California red-legged frog (*Rana aurora draytoni*) adults require dense riparian vegetation associated with deep still or slow moving water (Jennings et al. 1992). Heavily vegetated, terrestrial riparian areas may provide important wintering habitat, as they estivate in small mammal burrows and moist leaf litter within riparian vegetation up to 85 feet from water's edge (Rathburn et al. 1993).

Habitat loss and alteration are the primary factors in the decline of the red-legged frog. Wetland alterations include stream channelization, vegetation clearing, water diversions, and reservoirs. Livestock grazing and off-road vehicle activities also have contributed to red-legged frog decline. Grazing contributes to streambank erosion, resulting in sedimentation of riparian and aquatic habitats (Lusby 1970; Winegar 1977; Jennings et al. 1992). Additionally, removing vegetation can raise water temperature levels and promote bullfrog breeding. Off-road vehicle use affects red-legged frogs in ways similar to livestock grazing by damaging riparian vegetation and increasing erosion and siltation.

Currently, red-legged frogs are known from about 190 streams or drainages in 15 counties in central and southern California. In southern California, only four population localities are currently extant as compared with more than 80 historic locality records. The red-legged frog was listed as threatened under the Endangered Species Act of 1973, as amended, on June 24, 1996 (Federal Register 61(101):25813) due to past decline and current threats, including urban encroachment, reservoir construction, water diversion, and introduced predators and competitors.

Lowland leopard frog (*Rana yavapaiensis*) is distributed primarily throughout the lower Colorado River drainage, southern Arizona, and southwest New Mexico (Stebbins 1985). However, there is an isolated population southwest of the Salton Sea at San Felipe Creek (California Department of Fish and Game 1999). This species is usually found near water in deserts, grasslands, and oak or oak/pine woodlands. Lowland leopard frogs use permanent pools in streams, overflow ponds, and side channels of main rivers.

Desert slender salamander (*Batrachoseps aridus*) is isolated to palm oases, where they occur under limestone slabs and talus in the moist canyon bottoms (Stebbins 1985). Little is know about the conservation and recovery of this species. In the Salton Trough, the desert slender salamander is known to occur in Hidden Palms near Highway 74.

Sensitive Reptile Species

Desert tortoise (*Gopherus agassizi*) is widely distributed in the deserts of California, southern Nevada, extreme southwestern Utah, western and southern Arizona, and throughout most of Sonora, Mexico. In the Salton Trough, desert tortoise occurs near San Gorgonio Pass and on the alluvial fans of Coachella Valley (US Fish and Wildlife Service 1999). This widespread and once common taxon is rapidly decreasing in numbers due to habitat destruction from off-road vehicle use, agriculture, mining, and urban and residential development. Other factors contributing to the overall decline of desert tortoise include the spread of a fatal respiratory disease and from increases in raven populations that prey on juvenile tortoises. Recent data has indicated that many local subpopulations have declined precipitously. The appearance of Upper Respiratory Disease Syndrome, not identified in wild tortoises before 1987, may be a contributing factor (US Fish and Wildlife Service 1999).

Desert tortoises require friable, well-drained, sandy soil to construct nesting burrows (Zeiner et al. 1988). They are not found in areas of very cobbly soil, soil too soft to construct a burrow, or in dry lakes. In the Mojave Desert, the tortoise most often is found in association with creosote bush, Joshua tree woodland, and saltbush scrub vegetation communities. The species generally occurs below 4,000 feet elevation (Stebbins 1985). In the western Mojave Desert population, which includes the Salton Sea area, home ranges are five to 38 acres (Zeiner et al. 1988).

Western chuckwalla (*Sauromalus obesus obesus*) is a large-bodied lizard that inhabits rock outcrops and crevices in desert regions. It is widely distributed throughout the Mojave and Colorado deserts, from sea level to 4,000 feet (Zeiner et al. 1988). Often found in rock outcrops and boulder piles in creosote bush scrub, the chuckwalla is most active, depending on temperature levels, from mid-spring to fall. Sandy friable soil near boulders is required for egg laying (Stebbins 1985). The distribution of the chuckwalla includes appropriate habitats in the Salton Basin.

Colorado Desert fringe-toed lizard (*Uma notata notata*) occurs in the Colorado Desert south of the Salton Sea, from Imperial and San Diego counties south into northeast Baja California (Zeiner et al. 1988; Stebbins 1985). It is found in fine, loose, substrates of sand dunes, dry lakebeds, sandy beaches, riverbanks, desert washes, and sparse desert scrub, usually from below sea level to 300 feet elevation. Colorado fringe-toed lizard habitat is characterized by sparse vegetation, usually consisting of creosote bush or other shrubs (Stebbins 1985). This species is diurnal and hibernates from November to

February (Zeiner et al. 1988). To avoid predators, the lizard burrows into the sand and often appears to be "swimming" in the sand.

Silvery legless lizard (*Anniella pulchra pulchra*) prefers sparse vegetation occurring on sandy or loose loamy soils. Historical records (Klauber 1932) show the species in the San Felipe drainage. Little is known about this species or its distribution within the study area. Any further deterioration of potential habitat could eliminate it from the study area.

Coachella Valley fringe-toed lizard (*Uma inornata*) is found only in sand dunes in the Coachella Valley in Riverside County (Zeiner et al. 1988). It occurs from near sea level to 1,600 feet elevation in sparse desert scrub, alkali scrub, and desert washes and may be locally common in these habitats (Stebbins 1985; Zeiner et al. 1988). Coachella Valley fringe-toed lizards are insectivorous and escape from enemies by "swimming" in the sand. This species has lost over 75 percent of its habitat to development and other human activities (Stebbins 1985).

Flat-tailed horned lizard (*Phrynosoma mcalli*) inhabits areas of fine sand in washes and flats in the desert areas of San Diego, Imperial, and Riverside counties in California, southwestern Arizona, and northern Baja California and Sonora in Mexico. In the Salton Sea area it is distributed from the Coachella Valley south through the Salton Basin at elevations from below sea level to 600 feet. Documented locations for flat-tailed horned lizard near the Salton Sea include the vicinity of Cave Buttes east of the Salton Sea, Tarantula Wash west of the Sea, and near San Felipe Creek southwest of the Sea (California Department of Fish and Game 1999). The flat-tailed horned lizard is the subject of a multi-agency conservation agreement.

This lizard typically occurs in flat sparse desert scrub habitats dominated by creosote and bursage on fine, sandy, alkaline soils. Turner and Medica (1982) found that over 97 percent of total food intake was composed of ants. Harvester ants (*Veromessor pergandei, Polonomyrex californicus, and P. magnacantha*) composed 75 percent and *Conomyrma insana* composed 15 percent of the lizard's diet. Flat-tailed horned lizards are declining because of habitat loss from development and off-road vehicle use. It is estimated that up to 90 percent of the lizard's original geographic range is subject to or potentially subject to some form of human disturbance (Turner and Medica 1982).

Sensitive Mammalian Species

Mexican long-tongued bat (*Choeronycteris mexicana*) occurs in a variety of habitats ranging from arid thorn scrub to mixed oak-conifer forests (Arroyo-Cabrales et al. 1987). This species typically roosts in caves, mines, buildings, trees, or other dimly lit areas. Its diet apparently consists primarily of fruits, pollen, and nectar, with limited foraging on insects (Gardner 1977). Suitable habitat for this species occurs within the study area.

California leaf-nosed bat (*Macrotus californicus*) occurs in southern California, southern Nevada, southwestern Arizona, northern Sonora, and Baja California in Mexico (Williams 1986). In southern California it is found in Riverside, Imperial, San Diego, and San Bernardino counties (Zeiner et al. 1990a, 1990b). Coastal populations of this species have disappeared, and desert populations have declined, but it is still relatively common along parts of the Colorado River. It is found in desert riparian, desert wash, desert scrub, and palm oasis habitats. Preferred day roosts include caves or abandoned mines. California leaf-nosed bat occurs at up to 2,000 feet elevation in California, although in other states it can range up to 4,200 feet. It forages for insects by flying close to the ground.

The greater western mastiff bat (*Eumops perotis californicus*) occurs from central California southward into central Mexico. It occurs in many open, semi-arid to arid habitats, including coastal and desert scrub, annual and perennial grasslands, palm oases, chaparral, and urbanized areas. The greater western mastiff bat is detected most frequently over desert washes. Although the majority of the greater western mastiff bat populations are resident in California, some are thought to migrate from the colder areas and winter in lowland areas (Williams 1986). This species may travel up to 25 miles (40 kilometers) between roosting and foraging grounds. Although there are no known occurrences, suitable habitat does exist within the Salton Sea.

The range of the spotted bat (*Euderma maculatum*) extends from southern and eastern California north to southern Montana, west to central New Mexico, and south into northern Mexico. In California it is primarily found in foothills, mountains, and deserts of the southern part of the state (Zeiner et al. 1990a, 1990b). It is considered to be one of the rarest of North American mammals, and little is known about its habitat needs and natural history. The spotted bat is small (13- to 14-inch wingspan) and is black with three white spots on its back. It feeds primarily on moths, often over water. Spotted bats usually roost singly in rock crevices but occasionally use caves and buildings.

Western small-footed myotis (*Myotis ciliolabrum*) is a year-round resident in California that occurs in a wide variety of habitat types throughout the state. In the lower deserts of southern California, this species may forage on flies, moths, ants, and beetles over open desert scrub habitats. Habitat and historical records for this species occur within the study area.

Southwestern cave myotis (*Myotis velifer brivis*) prefers arid habitats dominated by creosote bush, palo verde, brittlebush, cactus, and desert riparian. Roosts are typically in caves or mines, but buildings and bridges also have been used. Although this species may have been extirpated from the study area by agricultural practices and habitat conversion, some habitat still exists but no recent surveys have been conducted (US Fish and Wildlife Service 1999).

Pale western big-eared bat (*Corynorhinus townsendii pallescens*) ranges from Mexico to British Columbia and the Rocky Mountain states and is found throughout California (Jameson and Peeters 1988). Within California, the distribution of the big-eared bat is not well delineated. It is found in a variety of habitats, except for alpine and subalpine habitats, and is most numerous in mesic habitats (Zeiner et al. 1990a, 1990b). The big-eared bat requires caves, mines, tunnels, or buildings for roosting and can use different locations for night, day, hibernation, and maternity roosts. The big-eared bat was once common in California but is now considered uncommon. The species is especially sensitive to disturbance, and bats may abandon a roost after a single visit by a person. Habitat in the study area is marginal for this species, but it could occur there.

Pallid bat (*Antrozous pallidus*) is a locally common species at low elevations in California (Zeiner et al. 1990a, 1990b). The sub-species *(A. pallidus pallidus*) most likely occurs in the Salton Trough. Pallid bats use a wide variety of open, dry habitats with rocky areas for roosting. It is a year-round resident in most of its range and hibernates in the winter. This species roosts colonially in caves, mines, crevices, and abandoned buildings. Pallid bats are very sensitive to disturbance at roost sites.

In California, pocketed free-tailed bat (*Nyctinomops femorosacca*) is rare in Riverside, San Diego, and Imperial counties but is more common to the south in Mexico (Zeiner et al. 1990 a, b). Habitats used by this bat include piñon juniper woodlands, desert scrub, desert riparian, desert wash, alkali desert scrub, Joshua tree, and palm oasis. Pocketed free-tailed bats roost in small groups in rock crevices in cliffs during the day and use rock crevices, caves, or buildings for maternity roosts. The species is thought to be active yearlong and forages over ponds, streams, and desert habitats for flying insects, especially large moths.

Big free-tailed bat (*Nyctinomops macrotis*) ranges from western Texas to southern California, and as far north as central Colorado and western Utah (Hall 1981). Big free-tailed bats typically occupy rugged rocky country but will forage over and migrate through most habitats throughout its range that are below 5,905 feet in elevation (Easterla and Whitaker 1973; Findley et al. 1975). Roosts are often in buildings, caves, and rock crevices. Although habitat for this species is limited within the study area, it likely occurs there at least during migration in the spring and fall.

Palm Springs round-tailed ground squirrel *(Spermophilus treticaudus chlorus*) is restricted to habitats with sandy substrates in the Coachella Valley. Vegetation communities occupied by the ground squirrel include creosote bush scrub, creosote-palo verde scrub, and saltbush/alkali scrub that support herbaceous growth (Ryan 1968; Williams 1986; Dodero 1995). According to the Wildlife Habitat Relationships System, sparse to open desert wash habitat with medium sized trees/shrubs is considered to be of high importance to round-tailed ground squirrels (Dodero 1995).

According to Williams (1986) the habitat for the ground squirrel has been substantially reduced by urbanization, cultivation, and construction of roads, railroads, airports, and golf courses. Additional threats include off-highway vehicle use that disturbs and degrades its habitat. The most extensive area in the Coachella Valley that still supports native habitat for the ground squirrel is found east of Interstate 10, from north of Indio to Desert Hot Springs and North Palm Springs; this is within the study area. Suitable habitat for this species also occurs in smaller patches throughout other portions of the study area.

The range of the pallid San Diego pocket mouse (*Chaetodipus fallax pallidus*) extends from San Bernardino County south to the US/Mexico border (Hall 1981). This species occurs in a wide variety of habitats, including alluvial fans, dry desert slopes, and piñon juniper woodlands. At lower desert elevations, pallid San Diego pocket mouse densities may have been recorded as high as 39 per hectare (Lackey 1996). This species is known to occur within the study area.

Palm Springs pocket mouse (*Perognathus longimembris bangsi*) is a subspecies of *Perognathus longimembris*. Little quantitative information is available on the ecology and life history of the Palm Springs pocket mouse. Palm Springs pocket mice are rather sedentary, with home ranges varying in size from 0.12 ha. to 0.56 ha. (Chew and Butterworth 1964). Habitat requirements for the Palm Springs pocket mouse are not well understood, but it is known to occupy sandy habitats on the desert floor. Its range extends from Joshua Tree National Park, Riverside County, southward through the Coachella Valley to Borrego Springs in San Diego County (Hall 1981). It is likely that this species occurs in many undeveloped portions of the study area.

The range of the Jacumba little pocket mouse (*Perognathus longimembris internationalis*) is generally more southerly then the Palm Springs pocket mouse, extending from Jacumba to approximately 62 miles south of the US/Mexico border. Habitat requirements for this subspecies are similar to those described above for the Palm Springs pocket mouse. Suitable habitat for this species occurs within the study area.

Southern grasshopper mouse (*Onychomys torridus ramona*) is common in the Mojave Desert and the southern Central Valley in California (Zeiner et al. 1990b). It prefers alkali desert scrub and desert scrub habitats and is less abundant in other desert habitats, such as desert riparian and wash areas. The grasshopper mouse feeds almost entirely on arthropods, and favored prey items include grasshoppers, crickets, scorpions, moths, and beetles. This species of mouse nests in abandoned burrows of other rodents, usually in dry friable soil with low to moderate shrub cover. The mice occur in pairs and are highly territorial and often widely spaced. The southern grasshopper mouse is considered beneficial to farmers because it eats potentially harmful insects (Zeiner et al. 1990a, 1990b).

Hispid cotton rat (*Sigmodon hispidus eremicus*) was first recorded in Imperial County in 1922 (Dixon 1922). This species primarily occurs in grassland and mixed grassland/scrub habitats but may also occur in agricultural fields. Habitat and historical records for this species occur within the study area.

Peninsular bighorn sheep (*Ovis canadensis cremnobates*) occupies the eastern escarpment of the Peninsular Mountain Ranges, from the San Jacinto Mountains in Riverside County, California, south about 100 miles to the US/Mexico border. The distribution of the bighorn sheep is defined in large part on the basis of available water and its use of two general habitat categories: mountain slope and canyon bottom (Schwartz et al. 1986; Bleich et al. 1990, 1997). Mountain slopes provide three types of necessary cover for the bighorn sheep: escape, thermal, and lambing (Welles and Welles 1961; Wilson et al.

1980). Suitable habitat for bighorn sheep occurs along the slopes, alluvial fans, and desert floor between the Salton Sea and the northwestern boundary of the study area.

3.8.5 Sensitive Habitats

Sensitive habitats are those that are considered rare within the region, that are considered critical habitat for special status species, or that have legal protection. Sensitive habitats found in the Sea area are wetlands and nonvegetated aquatic habitats ("waters of the US"), which include freshwater marsh, cismontane alkali marsh, Sonoran cottonwood-willow riparian forest/nonnative tamarisk scrub intermediate, open water, and mud flat habitats.

The wetlands and open water of the Salton Sea are included as regulated waters of the US. Wetlands are areas of land that, either permanently or seasonally, are wet and that support specially adapted vegetation. To regulate activities in wetlands, federal and state agencies have developed specific definitions and methods for identifying wetland boundaries. "Waters of the US" is the broadest category of regulated water bodies and includes navigable waters and wetlands. The US Army Corps of Engineers (ACOE) has jurisdiction over waters of the US, which include territorial seas and tidal and nontidal waters. Wetlands and waters of the US are subject to Clean Water Act permit provisions regulating their filling. The ACOE and USEPA have enforcement authority, with technical input from the US Fish and Wildlife Service. Wetland habitat is naturally limited, and remaining acreages are important habitats for migrant birds. Many bird species are restricted to riparian habitat and depend on it for breeding. Overall wildlife diversity is normally higher in riparian zones than in surrounding habitats. Such habitat, by occupying natural drainages, also functions to control water quality and erosion and often functions as a wildlife corridor. The CDFG considers riparian habitat a sensitive resource. Riparian habitat is specifically addressed by the CDFG Code Sections 1600-1606 (Streambed Alteration Agreement). The US Fish and Wildlife Service defines this habitat as a wetland (Cowardin et al. 1979).

Seepage along regional canals and intermittent waterways has induced wetland habitats in areas that were previously desert. These wetland areas are limited in size and number and do not support large numbers of species (see Figure 3.8-2).

3.8.6 Special Status Plant Species

Sensitive plant species include those listed as endangered, threatened, or rare by the US Fish and Wildlife Service, the California Department of Fish and Game (CDFG), or the California Native Plant Society (CNPS) (Skinner and Pavlik 1994). The CNPS listing is sanctioned by the CDFG and serves essentially as its list of "candidate" plant species; the CDFG recommends that all taxa listed by the CNPS be addressed in CEQA documents.

Thirty-six sensitive plant species are known to occur within the general area of the Salton Sea and are recorded in the (California Department of Fish and Game 1999). These species are listed in Table 3.8-2. Federal and state listed species that may occur in the Project affected areas are discussed below.

Coachella Valley milkvetch (*Astragalus lentiginosus var coachellae*) is a short-lived perennial herb that may behave as an annual (producing a single crop of seeds before dying) in years when environmental conditions are less than optimum. This plant is restricted to the Coachella Valley and is found in the windblown sand flats and dune hummocks. It is known from fewer than twenty occurrences (CNPS 1997) and is threatened by increasing urban development, grazing and trampling by livestock and feral burros, off-road vehicles, wind energy development, competition from nonnative plants, fisheries-related construction activities, and alteration of soil hydrology. This species is known to occur within the study area. Pierson's milk-vetch (*Astragalus magdalenae var peirsonii*) occurs within the deserts of California and Nevada. It is adapted to habitats with specific substrate or hydrologic conditions that occur as inclusions within creosote bush (*Larrea tridentata*) scrub or sagebrush (*Artemesia* spp.) dominated communities. This species also occurs on slopes and hollows of windblown dunes in the Sonora Desert. Populations of this species are threatened by grazing and trampling by livestock and feral burros, off-road vehicle use, military training, trampling by recreational users, competition from nonnative plants, urban development, construction related to fisheries development, and alteration of soil hydrology. Pierson's milk-vetch is known to occur within the study area.

Flat-seeded spurge (*Chamaesyce platysperma*) is endemic to sandy flats and dunes. It is known in California from only four collections (CNPS 1997). It flowers from

Table 3.8-2
Special Status Plants of Imperial and Riverside County

Species		**Status**		
Scientific Name	**Common Name**	**Federal***	**State***	**Other***
Astragalus insularis var. *harwoodii*	Harwood's milk-vetch			CNPS: 2
A. lentiginosus var. *coachellae*	Coachella Valley milk-vetch	Endangered		CNPS:1B
A. magdalenae var. *peirsonii*	Peirson's milk-vetch	Threatened	Endangered	CNPS:1B
A. tricarinatus	triple-ribbed milk-vetch	Endangered		CNPS:1B
Ayenia compacta	ayenia			CNPS: 2
Calochortus palmeri var. *munzii*	Munz's mariposa lily	Species of Concern		CNPS:1B
Carlowrightia arizonica	Arizona carlowrightia			CNPS: 2
Castela emoryi	crucifixion thorn			CNPS: 2
Chaenactis carphoclinia var. *peirsonii*	Peirson's pincushion			CNPS:1B
Chamaesyce arizonica	Arizona spurge			CNPS: 2
C. platysperma	flat-seeded spurge	Species of Concern		CNPS:1B
Croton wigginsii	Wiggins's croton		Rare	CNPS: 2
Cryptantha ganderi	Gander's cryptantha	Species of Concern		CNPS:1B
Ditaxis californica	California ditaxis	Species of Concern		CNPS:1B
D. clariana	glandular ditaxis			CNPS: 2
Erigeron parishii	Parish's daisy	Threatened		CNPS:1B
Escobaria vivipara var. *alversonii*	foxtail cactus	Species of Concern		CNPS:1B
Euphorbia misera	cliff spurge			CNPS: 2
Gilia maculata	little San Bernardino Mtns. gilia	Species of Concern		CNPS:1B

Helianthus niveus ssp. *tephrodes*	Algodones Dunes sunflower	Species of Concern	Endangered	CNPS: 1B
Lepidium flavum var. *felipense*	Borrego Valley peppergrass	Species of Concern		CNPS:1B
Lessingia glandulifera var. *tomentosa*	Warner Springs lessingia	Species of Concern		CNPS: 2
Linanthus floribundus ssp. *halli*	Santa Rosa Mtns. linanthus			CNPS:1B
Lycium parishii	Parish's desert-thorn			CNPS: 2
Marina orcuttii var. *orcuttii*	California marina	Species of Concern		CNPS:1B
Matelea parvifolia	spearleaf			CNPS: 2
Monardella robisonii	Robison's monardella	Species of Concern		CNPS:1B
Opuntia munzii	Munz's cholla (cactus)	Species of Concern		CNPS:1B
Palafoxia arida var *gigantea*	giant Spanish-needle	Species of Concern		CNPS:1B
Phaseolus filiformis	slender-stem bean			CNPS: 2
Pholisma sonorae	sand food	Species of Concern		CNPS:1B
Salvia greatae	Orocopia sage	Species of Concern		CNPS:1B
Selaginella eremophila	desert spike-moss			CNPS: 2
Streptanthus campestris	southern jewel-flower			CNPS:1B
Xylorhiza cognata	Mecca aster	Species of Concern		CNPS:1B
X. orcuttii	Orcutt's aster	Species of Concern		CNPS:1B

Sources:
Skinner, Mark W., and Bruce M. Pavlik. 1994. Inventory of Rare and Endangered Vascular Plants of California. CNPS, Sacramento, California; California Department of Fish and Game 1999.; US Fish and Wildlife Service 1999

* Federal and State Status have legal consequence. CNPS status are assigned for information only.

February to September and is undetectable during other times of the year or in years when environmental conditions are less than optimum. It has been found in the flats near Thousand Palms and may occur in other portions of the study area as well.

Wiggins's croton (*Croton wigginsii*) generally occurs at elevations of 164 and 328 feet in desert dune and Sonoran desert scrub habitats. Like all croton species, Wiggins's croton prefers areas with sandy or loose soils. It flowers from March to May. This species is known to occur within the study area.

Gander's cryptantha (*Cryptantha ganderi*) generally occurs at elevations of 525 to 1,312 feet in desert dune and Sonoran desert scrub habitats. It flowers from February to May. The primary threats to this species are development and off-road vehicle use (CNPS 1997). This species may occur in suitable habitats within the study area.

California ditaxis (*Ditaxis californica*) is found on rocky alluvial slopes around Palm Desert, Indian Wells, and La Quinta. The ecology of this species is poorly known. It appears to be an annual or a short-lived perennial that germinates and accomplishes most of its growth in summer after summer rains. If winter rains provide sufficient soil moisture, plants may continue to grow and flower during winter or early spring. This species is known to occur within the study area.

Foxtail cactus (*Escobaria vivipara* var. *alversonii*) generally occurs in sandy or rocky areas within Mohavean or Sonoran desert scrub habitats. It occurs between 246 and 4,921 feet elevation and flowers from April to June. One of the major threats to this species is horticultural collecting. This species is known to occur within the study area.

Little San Bernardino Mountain gilia (*Gilia maculata*) flowers from April to May. It is found in open sandy washes and along gravelly benches above the wash. Known populations occur in several washes in the vicinity of Desert Hot Springs. Because of its annual habit, populations are highly unstable from year to year. In years of low rainfall it may not germinate at all. It may be present within the study area where suitable habitat exists.

Algodones Dunes sunflower (*Helianthus niveus* ssp. *tephrodes*) is a perennial herb restricted to desert dune habitats in southeastern California. This species grows at elevations between 164 to 328 feet and blooms between September and May. This species may occur within the study area.

Munz's cactus (*Opuntia munzii*) is a shrub known from fewer than 10 occurrences (CNPS 1997). This species grows at elevations between 492 and 1,969 feet and blooms in May. It grows in sandy or gravelly soils in Sonoran desert scrub habitat. Known locations for this species are primarily in washes below the Chocolate Mountains along the eastern edge of the Imperial Valley. This species may occur within the study area.

Giant Spanish needle (*Palafoxia arida* var. *gigantea*) is an annual/perennial herb that grows primarily on desert dunes. This species grows at elevations between 49 and 326 feet and blooms between February and May. This species is likely to occur within the study area.

Sand food (*Pholisma sonorae*) is a perennial parasitic herb that occurs primarily in desert dunes. This species grows at elevations between 0 and 656 feet and blooms between April and May. It is parasitic to many species, including members of the genuses *Eriogonum*, *Tiquilia*, *Ambrosia*, and *Pluchea*. This species is likely to occur within the study area.

Orocopia sage (*Salvia greatae*) is an evergreen shrub that flowers from March to April. It is found locally in the vicinity of Dos Palmas and the Orocopia and Chocolate mountains. It occurs on alluvial slopes between 98 and 787 feet in elevation. This species is known to occur within the study area. Surveys for Orocopia sage should be conducted only during its flowering period.

Mecca aster (*Xylorhiza cognata*) is endemic to the Mecca and Indio Hills of the Coachella Valley and occurs mostly on steep sedimentary slopes and along washes. Its primary threat is off-road vehicle use and associated recreational impacts. This species is known to occur within the study area.

Orcutt's aster (*Xylorhiza orcuttii*) is a perennial herb that flowers from March to April. It occurs primarily in Sonoran desert scrub habitats in Imperial, Riverside, and San Diego counties. This species grows at elevations between 66 and 1,181 feet. This species is known to occur within the study area.

3.9 SOCIOECONOMICS

3.9.1 Introduction

The affected environment discussion for socioeconomics includes regional employment, income, recreational related expenditures, finance, demographics, and housing. The Phase I study area is composed of Imperial and Riverside counties in California. This area was selected because the Salton Sea is within the boundaries of both counties, and most economic effects from the use of and management of the Sea are within the two-county region. Businesses within Imperial and Riverside counties provide most of the goods and services required by activities and industries that depend on the Salton Sea. Likewise, most employees of these businesses reside in the region, with few people commuting from other counties.

The Salton Sea has two important functions for the economies of the study area. First, it is a recreational resource, attracting visitors primarily from southern California and secondarily from other areas of the United States. Thus, the Sea generates tourist-based income and employment for the surrounding communities. Second, it represents an essential infrastructure for the local economy by serving as a repository for stormwater and agricultural runoff from the Imperial and Coachella valleys. Historically, this agricultural repository function was the primary purpose of the Salton Sea (Development Research Associates 1969). The sea also provides a number of other functions that influence the local economies, including providing subsistence fishing for local Native Americans and serving as an aesthetic asset to the region.

There are differences in the relative importance of the Salton Sea to the economies of the two counties. Coachella Valley of eastern Riverside County drains to the Sea, but the more populous areas of Riverside County, west of the San Jacinto Mountains, are more closely tied to the industrial economies of coastal communities, primarily the Los Angeles metropolitan area. Most economic activities in Imperial County, including agricultural production, occur in the Imperial Valley, making the Salton Sea an important component of the local economy. Therefore, most direct economic effects from restoring the Salton Sea are expected to occur in communities within the immediate vicinity of the Sea. This region is considered the area of primary influence and includes the communities of Westmorland, Mecca, Coachella, Calipatria, Niland, and Salton City and other unincorporated areas within 15 miles of the Sea.

Data for this section was obtained from the US Census Bureau (1998), the Bureau of Economic Analysis (1998), the California Department of Finance (1998), and the California Board of Equalization (1998) and from other regional economic studies. Two specific studies are incorporated by reference. First, the Salton Sea Management Project Economic Profile Study (Onaka Planning and Economics et al. 1995) provides a detailed account of the economic characteristics of the region between 1980 and 1995. Second, Economic Benefits Derived from Water and Lands Surrounding the Salton Sea (Development Research Associates 1969) provides a historical record of economic conditions prior to the degradation of the Sea.

Data for this section are provided for the most recent year available. Due to time lags in data collection and processing, most data series are for 1996 and 1997. Current conditions are expected to be similar in scale and magnitude because no major events have occurred in the area to substantially affect economic trends. Most sources aggregate data on a county level; therefore, data are provided for Imperial and Riverside counties and more specifically for the area of primary influence, where relevant and where data is available.

3.9.2 Regional Economics

Employment

The civilian labor force within the study area is about 697,900 people, 92 percent of who reside in Riverside County. In 1997, Riverside County had an average unemployment rate of 7.5 percent, while the more rural Imperial County had a unemployment rate of 26.5 percent (California Department of Finance 1998). The primary employment sectors in the study area include the service sector, retail trades, and government employment. Major employment sectors for 1994 and 1996 are shown on Table 3.9-1.

Government employment consisted of over 90,000 jobs during 1996, representing approximately 16 percent of the study area employment. Within the study area, approximately 90 percent of the jobs are in Riverside County, mostly in urban areas. While both Imperial and Riverside counties have diversified economies, the proportion of persons employed in farming in Imperial County (approximately 15 percent) is higher than in Riverside County (approximately five percent).

Table 3.9-1
Selected Study Area Employment Data 1994 and 1996

	1994	1996	1996 Percentage of Total	1994-1996 Percentage Change
TOTAL EMPLOYMENT	553,659	587,703	100.00%	6.15%
Private	446,212	476,951	81.16%	6.89%
Agriculture, Forestry, Fisheries, & Other[1]	26,982	28,349	4.82%	5.07%
Mining	1,726	999	0.17%	-42.12%
Construction	37,073	42,511	7.23%	14.67%
Manufacturing	43,477	47,942	8.16%	10.27%
Transportation & Public Utilities	18,541	18,486	3.15%	-0.30%
Wholesale Trade	17,084	18,293	3.11%	7.08%
Retail Trade	104,331	109,353	18.61%	4.81%
Finance, Insurance, & Real Estate	39,614	37,520	6.38%	-5.29%
Services	157,384	171,320	29.15%	8.85%
Government and Govt. Enterprises	91,673	93,808	15.96%	2.33%
Federal, Civilian	7,660	7,859	1.34%	2.60%
Military	7,277	4,063	0.69%	-44.17%
State & Local	76,736	81,886	13.93%	6.71%

Source: BEA 1998.

[1]Other: Number of jobs held by US residents employed by international organizations and foreign embassies and consulates in the US.

Agriculture is the dominant industry within the primary area of influence, providing one in three jobs. Operators and laborers is the next largest occupational category. When combined, these industries account for about half of all employment around the Salton Sea. Unemployment in the region is variable, due to seasonal jobs. Historically, unemployment in the area of primary influence has varied between eight and fourteen percent.

Less than two percent of persons in the area of primary influence are employed in businesses that cater to recreational visitors to the Salton Sea. This is a sharp decline from the 1960s when the recreational-based industry was second only to agriculture in employment (Development Research Associates 1969). According to a 1989 survey of 89 businesses in the immediate vicinity of the Salton Sea, of the 16,000 workers in the region, only 315 were full-time equivalent workers in recreational-based industries (Onaka Planning and Economics et al. 1995; CIC Research 1989). This number is not expected to have changed substantially over the last ten years.

Income Generation

Income levels for 1990 and 1996 in the study area are shown in Table 3.9-2. Average per capita income for the study area was $19,442 in 1996, an increase of approximately 5.5 percent since 1994. Total personal income exceeded $30 billion, an increase of greater than nine percent between 1994 and 1996. The 1996 per capita income level for Riverside County was $19,950, which is average for the state, while Imperial County was at $14,394, one of the lowest in the state (BEA 1998). Average wages per job in Riverside County averaged $24,124 in 1996, and they were $20,630 in Imperial County (California Department of Finance 1998).

Table 3.9-2
Summary of Study Area Income 1994 to 1996

	1994	1996	Percentage Change 1994 to 1996
Total Income[1]	27,580,257	30,270,190	9.7%
Per Capita Income	$18,427	$19,442	5.5%

Source: BEA 1998
[1] Thousands of dollars.

Recreational-related Expenditures

Based on a 1989 telephone survey of southern California households, the residents of some 154,600 households visited the Salton Sea in 1987 (CIC Research 1989). The study estimated that the total use rate amounted to 2.6 million visitor-days. The study further estimated that visitors to the Salton Sea spent $99 million (1994 dollars) throughout southern California, of which $69 million was spent in Imperial and Riverside counties. On average, visitors to the Salton Sea spent $26 per person per day in the two counties. This spending created secondary effects, generating an estimated total economic impact of $385 million in southern California, of which $129 million was attributed to Imperial and Riverside counties. Total economic impact includes the direct expenditures by visitors and secondary expenditures by residents and businesses providing goods and services to the visitors.

A 1995 study estimated local expenditures by bird-watchers visiting the Sonny Bono Salton Sea National Wildlife Refuge (Kerlinger 1995). About 54,000 of 60,000 annual visitors to the wildlife refuge engaged in bird watching. A survey of the visitors indicated that the average length of stay was 3.0 days, resulting in total use-rate of 162,000 visitor-days. The visitors spent a total of $3.1 million in the Salton Sea area for lodging, food, gasoline, and other items, or an average of $19 per person per day.

3.9.3 Finance

Taxable retail sales in the study area increased by 5.5 percent between 1996 and 1997, totaling $9.2 billion in 1997 (California Department of Finance 1998). This represents 3.8 percent of total state retail sales and is a 28 percent increase from 1990. Over 92 percent of the sales tax was collected in Riverside County. The sales tax rate in both Imperial and Riverside counties is 7.75 percent. Most cities within the area of primary influence have experienced growth in taxable retail sales, although generally at a lesser degree than the study area as a whole. Historically, there has been a low average retail sales per capita in the area of primary influence. This suggests that residents purchase many products outside the local area, resulting in a “leakage” of retail sales to other areas within the study area.

The assessed value of the property subject to property taxes within the study area totaled $2.5 billion in 1998. This represents an increase of 9.4 percent from 1997 for Imperial County and a decrease of 3.0 percent for Riverside County. Of the total assessed value of the property, just over 20 percent is within the area of primary influence. Of note, Calipatria has approximately $49 million in assessed property subject to property taxes, Coachella has $420 million, and Westmorland has $29 million (California Board of Equalization 1998).

In Imperial County, eight percent of property taxes goes to city governments, 20 percent to the county, 61 percent to school districts, and 11 percent to other districts. In Riverside County, six percent of property taxes goes to city government, 13 percent to the county, 48 percent to school districts, and 33 percent to other districts (California Board of Equalization 1998).

3.9.4 Demographics and Housing

The population of the 7.3 million-acre study area totaled 1,591,497 in 1997, representing a 21.96 percent increase since 1990. Approximately 91 percent of the study area population reside in Riverside County, mostly in urban areas west of the San Jacinto Mountains (US Census Bureau 1998). About 45,000 people, or three percent of the total study area population, reside in the area of primary influence. Three quarters live along the northern shore of the Salton Sea in Riverside County (California Department of Finance 1998).

The population and racial characteristics of the study area are shown in Table 3.9-3. Among racial groups, whites made up the majority of residents in the study area, at approximately 89 percent. Racial characteristics appear to have changed little since 1990. Additional information on the racial and income status of the local population is provided in Section 3.18, Environmental Justice.

Table 3.9-3
Profile of study area Population Characteristics in 1990 and 1997

	1990	1990 Percentage of Total	1997	1997 Percentage of Total	Percentage Change 1990 to 1997
Total Population	1,304,893	100.00%	1,591,497	100.00%	21.96%
White	1,169,525	89.63%	1,416,693	89.02%	21.13%
African American	71,576	5.49%	86,649	5.44%	21.06%
Asian	16,258	1.25%	18,971	1.19%	16.69%
American Indian	47,534	3.64%	69,184	4.35%	45.55%
Persons of Hispanic Origin[1]	385,174	29.52%	574,593	36.10%	49.18%

Source: US Census 1998
Note: Percentages may not equal 100 due to rounding.
[1] Hispanic Origin is an ethnic rather than racial category. Persons of Hispanic origin can be of any race.

There were 602,252 housing units in the study area during 1998, about 93 percent of which were in Riverside County. Since 1990, the region has experienced a 14 percent increase in housing units. Both Imperial and Riverside counties have had an average two percent annual increase in housing units. The growth has been relatively uniform throughout both counties. While the increase in housing is slightly more pronounced in the more urban western portion of Riverside County, a relatively high increase also has occurred in the Coachella Valley, including in communities along the northern shore of the Salton Sea.

The 1998 vacancy rate for Imperial County was 9.7 percent, down 0.5 percent from 1990. For Riverside County, the rate was much higher at 17.0 percent, just about even with the rate in 1990 (California Department of Finance 1998).

Between 1980 and 1990, total housing in the communities around the Salton Sea increased by 4,618 units, 4,250 of which were in Riverside County and 368 of which were in Imperial County. Historically, this area has had a relatively high vacancy rate, averaging around 20 percent. This is primarily due to seasonal units (primarily in Imperial County) and unoccupied inventory of new housing, particularly in Coachella City.

3.10 LAND USE

3.10.1 Introduction

The affected environment discussion for land use and planning includes urban land use, commercial and industrial land use, public land use, and local land use plans and policies. Agricultural land uses are discussed in the next section, Agricultural Land Resources. Land use compatibility with different noise conditions is discussed in Section 3.5, Noise.

3.10.2 Land Ownership

The area within and surrounding the Salton Sea is a diverse mixture of private and public ownership. Much of the area is a checkerboard pattern on public and private ownership. (Land uses are discussed below and shown on Figure 3.10-1.) The study area comprises approximately 390,000 dry-land acres in Riverside and Imperial counties. Most of this land is privately held and is urban, commercial, agricultural, or desert land. Federal, state, and local agencies administer the balance of the study area. In addition, formation of the Sea resulted in the inundation of approximately 190,000 acres of public and private lands. Inundated lands are also a checkerboard pattern of ownership.

Federal Land Ownership

Approximately 150,000 acres (39 percent) of the study area is under federal management. BLM is the principal federal landholder, administering approximately 68,000 dry-land acres (18 percent). Military land withdrawals comprise approximately 7,945 dry-land acres and 13,642 in-Sea acres. USFWS administers approximately 53,000 acres in and around the Sea. The majority of inundated lands are federal lands administered by BLM or withdrawn by Reclamation. Additional inundated lands are public lands held as public water reserves.

State and Local Land Ownership

Approximately 15,000 acres (4 percent) of the study area is managed by California State agencies. CDPR is the largest State landholder. Local government land ownership comprises a nominal portion of the area around the Sea.

Private Land Ownership

Privately owned lands comprise the majority of the area around the Sea, approximately 220,000 acres (56 percent). These lands are owned by numerous individual entities, including IID and Torres Martinez band of the Cahuilla Desert Indian Tribe. The Torres Martinez Tribe holds approximately 13,000 acres of land north and west of the Sea. These holdings are interspersed with private holdings and BLM land and are held in trust by the Bureau of Indian Affairs (BIA). Approximately 10,000 acres of tribal lands are also submerged by the Sea. IID and other private entities also own substantial areas of inundated land.

3.10.3 Urban Land Use

Urban land uses in the study area are primarily unincorporated communities adjacent to the Salton Sea or in the Coachella and Imperial valleys. The unincorporated communities of Mecca and North Shore are on the north side of the Sea in Riverside County. Mecca and North Shore consist of scattered single-family homes, RV parks, beaches, a marina, and scattered commercial uses.

The West Shores/Salton City area in Imperial County extends along the western shore from the northern Imperial County line to the Salton Sea Test Base. Within this area are several unincorporated communities, such as Salton City, Vista Del Mar, Salton Sea Beach, and Desert Shores. These communities consist mostly of single-family homes, RV and trailer parks, marinas, and community services. Although a significant amount of the land area is subdivided, most of the residential lots are undeveloped.

Hot Mineral Spa/Bombay Beach is an unincorporated community that extends along the east shore of the Sea from the northern Imperial County line to Bombay Beach. Most urban land uses in this area are single-family homes and RV parks. Recreational facilities include a marina, campground, and mineral spas.

Southeast of the Salton Sea are the unincorporated community of Niland and the incorporated communities of Calipatria and Westmorland. Niland contains mostly single-family homes, while Calipatria and Westmorland include a larger number of residential, commercial, and urban uses.

Occasional residences are found throughout the study area. There are no large urban areas in the study area.

3.10.4 Commercial and Industrial Land Uses

Commercial uses in the study area mostly provide services for tourists and area residents. Industrial uses in the study area mostly consist of geothermal power production.

Commercial recreation facilities found in the study area include beaches, campgrounds, marinas, RV parks, mineral spas, and hunting clubs. Most of these facilities are along the western shore in the Salton City/Desert Shores area or along the northeastern shore between North Shore and Bombay Beach. Several hunting clubs are near the southeast shore. Other commercial activities that support tourism and area residents are found in urban areas, as discussed previously, and along highways 86, 195, and 111. Geothermal power production plants are near the southeastern edge of the Salton Sea.

3.10.5 Public Land Use

Public lands in the study area are managed by federal agencies, including the BLM, US military, and USFWS and by state agencies, including CDFG, CDPR, and the California State Lands Commission. Several county recreation areas are also in the study area.

Federal Land

BLM lands are primarily found along the east and west sides of the Sea and are managed by the Palm Springs and El Centro field offices. BLM lands interspersed with other federally withdrawn, tribal, and private lands. These lands are managed for multiple use, including grazing, recreation, and mineral extraction, in accordance with the California Desert Plan (CDP) (BLM 1981). The CDP assigns use classifications to public lands according to resource values present.

The US Navy manages significant land areas around the Salton Sea. The Navy manages the Salton Sea Test Base on the southwest shore and within the Sea. The base has been used for military training since its establishment in 1942. With the exception of brief periods of use, the base has been abandoned since the 1970s and was designated for closure by the 1989 Base Realignment and Closure Commission. Except for two occasions, live-fire weapons testing and training was not conducted on the base, however, due to these two live-fire training events, unexploded ordnance (UXO) may be found on the site. The US Navy has conducted a physical search of the entire land area of the base and subsurface investigations on 150 acres of the base. The in-Sea portion of the base was not surveyed. UXO was found to be very limited. Please see Section 3.14 Public Safety and Environmental Hazards for further discussion of UXO. Cleanup prior to closure is proceeding and transfer of ownership to other federal agencies is being considered. The base remains a military land use until the property has been conveyed to another federal agency.

The Naval Air Facility El Centro is to the southwest, and the US Marine Corps Chocolate Mountains Gunnery Range is to the east of the Salton Sea. While both of these facilities are within the Salton Sea watershed, only small areas are within the study area for Phase I restoration activities. Both facilities are active military training areas and include live-fire weapons training activities.

The USFWS manages dry and inundated land areas as the Sonny Bono National Wildlife Refuge. The largest portion of the refuge covers the southern third of the Salton Sea; smaller land areas are on the southern and eastern shores. USFWS also manages a small area of CDFG property (Imperial Wildlife Area-Hazard Unit) on the eastern shore.

State Land

The CDPR manages the Salton Sea State Recreation Area on the northeast shore of the Sea and the Anza-Borrego Desert State Park to the west in the Santa Rosa Mountains. CDFG manages the Imperial Wildlife Refuge Area-Wister Unit on the east shore of the Salton Sea near Niland. The California State Lands Commission owns several areas of land east, west, and within the Salton Sea. These lands are interspersed with private and federal lands.

Local Government Land

Two Imperial County parks are on the eastern shore, Red Hill Marina on the southeast edge of the Sea, west of Niland, and Niland Marina County Park, on the eastern shore, west of the Salton Sea State Recreation Area and Bombay Beach.

3.10.6 Local Land Use Plans and Policies

The Riverside and Imperial county general plans provide the policy framework for land use planning in the study area. Although San Diego County extends to within approximately three miles of the western edge of the Sea, this area is completely occupied by the Anza-Borrego Desert State Park. Since land within the park is managed by the state, San Diego County land use policies are not binding and are therefore not discussed further.

Riverside County General Plan

The northern third of the Salton Sea is in the Coachella Valley of Riverside County. Land use in this region is guided by the Eastern Coachella Valley Plan (ECVP) of the Riverside County Comprehensive General Plan (Riverside County. 1995). Land uses in the ECVP area include open space and conservation, residential, commercial, and industrial/manufacturing. Most of the area is designated as open space and conservation, including agriculture, parks, and areas of water, desert, and mountainous terrain.

Agriculture is the largest land use category in the ECVP and occupies almost the entire area adjacent to the Sea. The Salton Sea State Recreation Area on the northeastern shore of the Sea is designated as parkland and is the only shoreline area in the ECVP not designated as agriculture. To the east, west, and northeast, away from the shoreline, are areas designated as desert lands. Farther to the west, at the base of the Santa Rosa Mountains, is a strip of land designated as planned residential reserve. Residential areas include Mecca and North Shore. Small areas of commercial and industrial/manufacturing are found near Mecca and North Shore, as well as along highways 86 and 111 in agricultural and desert areas.

Specific objectives or policies of the ECVP that would be relevant to the Salton Sea Restoration Project include the following:

- Maintain compatibility with surrounding land uses, including such factors as intensity of use, hazards, nuisances, aesthetics, and design (Land Use Policy 1[d]);
- Discourage uses that may conflict with agricultural activities from locating in agricultural areas (Land Use Policy 1[g]); and
- Carefully control and manage natural resources, such as soil, water, vegetation, air, wildlife, and mineral resources (Open Space Objective 2).

Imperial County General Plan

The southern two thirds of the Salton Sea is within Imperial County. Land uses within the affected area include agriculture, government/special public, urban, recreation/open space, rural residential, and community area (Imperial County. 1997).

Agriculture is the largest land use category adjacent to the Salton Sea. Agricultural land use extends around the Sea from the Salton Sea Test Base on the southwest shore, to Salton Sea State Recreation Area on the eastern shore. Within the agricultural area are small urban areas, such as Westmorland, Calipatria, and Niland. The Salton Sea Test Base and Salton Sea State Recreation Area are designated as Government/Special Public Land Uses.

The general plan identifies several areas adjacent to the Salton Sea that are characterized by urban or urbanizing uses. Land use in these areas is guided by urban and community area plans that implement the land use element of the general plan. Land use in the unincorporated area west of the Sea to Highway 86 and between the Imperial/Riverside county line and the Salton Sea Test Base is guided by the West Shores/Salton City Urban Area Plan. The Niland Urban Area Plan guides land uses around the unincorporated area of Niland on the eastern side of the Sea. Land use in the unincorporated area east of the Sea and between the county line and Bombay Beach is guided by the Hot Mineral Spa/Bombay Beach Community Area Plan. A small area of rural residential extends east from the Bombay Beach Community Plan area.

Specific goals or objectives of the Imperial County General Plan that would be relevant to the Salton Sea Restoration Project include the following:

- Preserve commercial agriculture and discourage incompatible development adjacent to productive agricultural lands (Objectives 1.1 and 1.2);
- Promote water recreation activities in suitable areas along the Salton Sea (Objective 3.9); and
- Identify and pursue funding sources for cleanup of the Salton Sea (Objective 3.10) and establish policies and programs for maintaining salinity levels (Objective 9.5).

3.11 AGRICULTURAL LAND RESOURCES

3.11.1 Introduction

The affected environment discussion for agricultural resources includes farmland classifications, agricultural land use, and agricultural economics. Although the potential impact on agricultural land use would be limited to the Coachella and Imperial valleys, the Phase I study area includes all of Imperial and Riverside counties because the economic effects resulting from impacts to agriculture would extend throughout the counties.

Agriculture is the most significant economic activity in the Salton Basin. The fertile soil and mild climate of the region allow year-round planting, cultivation, and harvest. The current total acreage under irrigation is about 520,000 acres, with about 460,000 acres in Imperial Valley and 60,000 acres in Coachella Valley, about the same acreage that has been under irrigation since the 1960s. Agriculture in the Salton Basin depends on the Sea as a repository for its drainage water, while the Sea depends on the continuation of these drainage waters to sustain the water level. All project alternatives have been developed with a common goal to maintain the Sea's ability to receive agricultural runoff so that agricultural practices in the Coachella and Imperial valleys can continue. Agricultural land also provides important habitat for the numerous resident and migratory bird species that use the Salton Sea.

3.11.2 Farmland Classifications

The NRCS is responsible for maintaining an inventory of the nation's farmlands. In order to map these lands, the NRCS designates four basic types of important farmland: prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance. Prime farmland and farmland of statewide importance may be used for crops, pasture, range, forestry, or other uses but may not be used for urban or water uses. The California Department of Conservation Farmland Mapping and Monitoring Program provides biennial mapping of California's important farmlands.

Prime farmland is land best suited for producing food, feed, forage, fiber, and oilseed crops and also is available for these uses. Prime farmland has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops when treated and managed (including water management) according to current farming methods.

Farmland of statewide importance is land other than prime farmland that has a good combination of physical and chemical characteristics for producing crops. These lands differ from prime farmland in that they may have minor shortcomings, such as greater slope or less ability to store soil moisture.

Unique farmland does not meet the criteria for prime farmland or farmland of statewide importance but is used for producing specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to modern farming methods. Examples of such crops are citrus, olives, avocados, rice, grapes, and cut flowers.

Farmland of local importance is land other than prime, statewide, or unique that is producing crops or that has the capability of production and may be important to the local economy. These lands are identified by a local committee made up of concerned agencies that review the lands under this category at least every five years.

The Farmland Protection Act (P. L. 97-98) of 1981 requires all federal agencies to consider the effect of programs on farmland. Federal agencies are required to develop criteria to evaluate the effect of federal programs on the conversion of agricultural lands to nonagricultural uses. Federal agencies must, to the extent practicable, consider alternatives or mitigation that lessen the impact on farmland conversion.

The California Land Conservation Act of 1965 (Williamson Act) established a voluntary tax incentive program for preserving agricultural and open space land. To be eligible for the Williamson Act program, land must be within a county-designated agricultural preserve. Lands under Williamson Act contracts are restricted to agricultural use, and the property owner is taxed according to the income that the land is capable of generating in agriculture. Williamson Act contracts extend for 10 years and are automatically renewed unless a notice of nonrenewal is issued or an application for cancellation of the contract is approved. Cancellation of the contract requires that the purpose be consistent with the Williamson Act or in the public interest.

3.11.3 Agricultural Land Use

Riverside County

Approximately 18 percent of land in Riverside County is agricultural. The Coachella Valley, north of the Salton Sea, is one of the county's largest agricultural areas, with approximately 54,000 acres in agriculture. Irrigated agriculture in the Coachella Valley began in the late 1800s with the development of local ground water supplies. The Coachella Valley Irrigation District was established in 1918 to manage the local supplies and to plan for supplemental sources. In 1949, the Coachella Canal was completed and supplied water to the valley from the Colorado River. The Coachella Valley Irrigation District currently supplies water to almost 60,000 acres of agricultural land.

Most of the Coachella Valley is designated as important farmland (Figure 3.11-1). Within the Coachella Valley there are approximately 60,000 acres of prime farmland, 1,000 acres of farmland of statewide importance, 11,000 acres of unique farmland, and 27,000 acres of farmland of local importance (California Department of Conservation 1999).

In 1997, there was approximately 500,000 acres of agricultural land in Riverside County, increased from approximately 420,000 acres in 1992. The total amount of irrigated land also increased during this period, from approximately 190,000 acres to 220,000 acres. Riverside County ranked third among California in 1996 in conversion of agricultural land to nonagricultural uses, with approximately 6,400 acres of agricultural land conversions. Agricultural conversions included the development of housing subdivisions in the Coachella Valley. Riverside County also ranked third in the state in the conversion of irrigated land to urban uses, with 1,642 acres lost between 1994 and 1996 (California Department of Conservation 1998).

Imperial County

Approximately 11 percent of land in Imperial County is agricultural. Most of the agricultural land, especially irrigated agricultural land, is within the Imperial Valley. An approximately 300-acre citrus orchard is located south of the former Salton Sea Test Base, between the Sea and Highway 86.

Large-scale irrigated agriculture in the Imperial Valley began in the early 1900s when the California Development Company constructed a canal to divert water from the Colorado River. Following the flooding of the Imperial Valley by the Colorado River in 1905 (which created the Salton Sea), the Imperial Irrigation District was formed. The district began acquiring the assets of the California Development Company and 13 other water companies. The All American Canal, completed in 1942, supplied water from the Colorado River to the Imperial Valley. The IID currently supplies water to nearly 500,000 acres of agricultural land.

Most land in the Imperial Valley is designated as important farmland (Figure 3.11-1). Within the Imperial Valley there are approximately 15,000 acres of prime farmland, 30,000 acres of farmland of statewide importance, 500 acres of unique farmland, and 24,000 acres of farmland of local importance (California Department of Conservation 1999). Imperial County does not participate in the Williamson Act program.

The total amount of agricultural land in Imperial County in 1997 was approximately 490,000 acres, decreased from approximately 533,000 acres in 1992. The total amount of irrigated land increased during this period from approximately 407,000 acres to 438,000 acres (California Department of Conservation 1998).

3.11.4 Agricultural Economics

Riverside County

Riverside County ranked ninth in California counties in 1997 with $1.09 billion worth of agricultural production. The top ten agricultural products in the county in 1997 were milk, table grapes, eggs, nursery plants, hay, dates, avocados, cattle, grapefruit, and lemons. Coachella Valley alone produced $332 million worth of agricultural crops in 1997. Tree and vine crops, such as grapes and dates, produced in 1997 were valued at approximately $172 million, while vegetable and melon crops, such as peppers, watermelon, and carrots, were valued at approximately $121 million. Most of Coachella Valley, 23,000 acres (42 percent), was planted in vegetable and melon crops, while a slightly smaller area, approximately 20,000 acres (37 percent), was planted in tree and vine crops (noncitrus) (Riverside County 1998).

In 1997, there were 3,048 farms in Riverside County. While the number of farms dropped from 3,511 in 1992, the average size of farms during this period increased from 121 acres to 167 acres (US Department of Agriculture 1997a). Agriculture is a significant employer in this area (see Section 3.9 for a discussion of socioeconomics in Riverside County).

Imperial County

Imperial County ranked tenth in California counties in 1997, with $1.04 billion worth of agricultural production. The top agricultural products in the county in 1997 were cattle, alfalfa, carrots, sugar beets, lettuce, hay, wheat, cantaloupes, and broccoli (Imperial County 1998).

Vegetable and melon crops produced in 1997, such as lettuce, carrots, broccoli, and cantaloupes, were valued at approximately $417 million. Field crops, such as alfalfa, sugar beets, and hay, were valued at $331 million. The largest area of the Imperial County, 420,000 acres, was planted in field crops, while a much smaller area, 107,000 acres, was planted in vegetable and melon crops (Imperial County 1998).

In 1997 there were 557 farms in Imperial County, down from 657 in 1992. During the same period, the average size of farms in the county has increased from 811 acres to 879 acres (US Department of Agriculture 1997b). Agriculture is a significant employer in Imperial County (see Section 3.9 for a discussion of socioeconomics in Imperial County).

3.12 RECREATIONAL RESOURCES

3.12.1 Introduction

The affected environment discussion of recreational resources includes regional and local recreation uses, opportunities, and constraints. Recreation resources in the Salton Sea Phase I study area include a wide range of activities, from water-based to land-based. This section describes the existing recreational use of the Sea based on effects of reduced water quality and fluctuating surface elevation. This discussion combines the needs of local residents with those of visitors from out of the region and does not address local resident recreation programs or facilities. The alternatives proposed by the Salton Sea Authority for Phase I could have both positive and negative impacts on the existing and potential recreational use of the Sea and surrounding regional recreation.

The extent of recreation surrounding the Salton Sea ranges from birding to off-highway vehicle (OHV) use. The most common local recreational activities existing around the Sea include sport fishing, boating, bird watching, camping, hunting, ecotourism, OHV use and rock hunting. Due to issues relating to water quality and lack of land-related facilities, some past popular recreation activities have greatly declined or have ceased to exist. Such recreation activities as swimming, water skiing, boat racing, and personal water craft (PWC) racing, which were once popular activities, are close to nonexistent today. The trend for recreation adjacent to the waters of the Sea has changed from water/body contact activities to non-water/body contact activities.

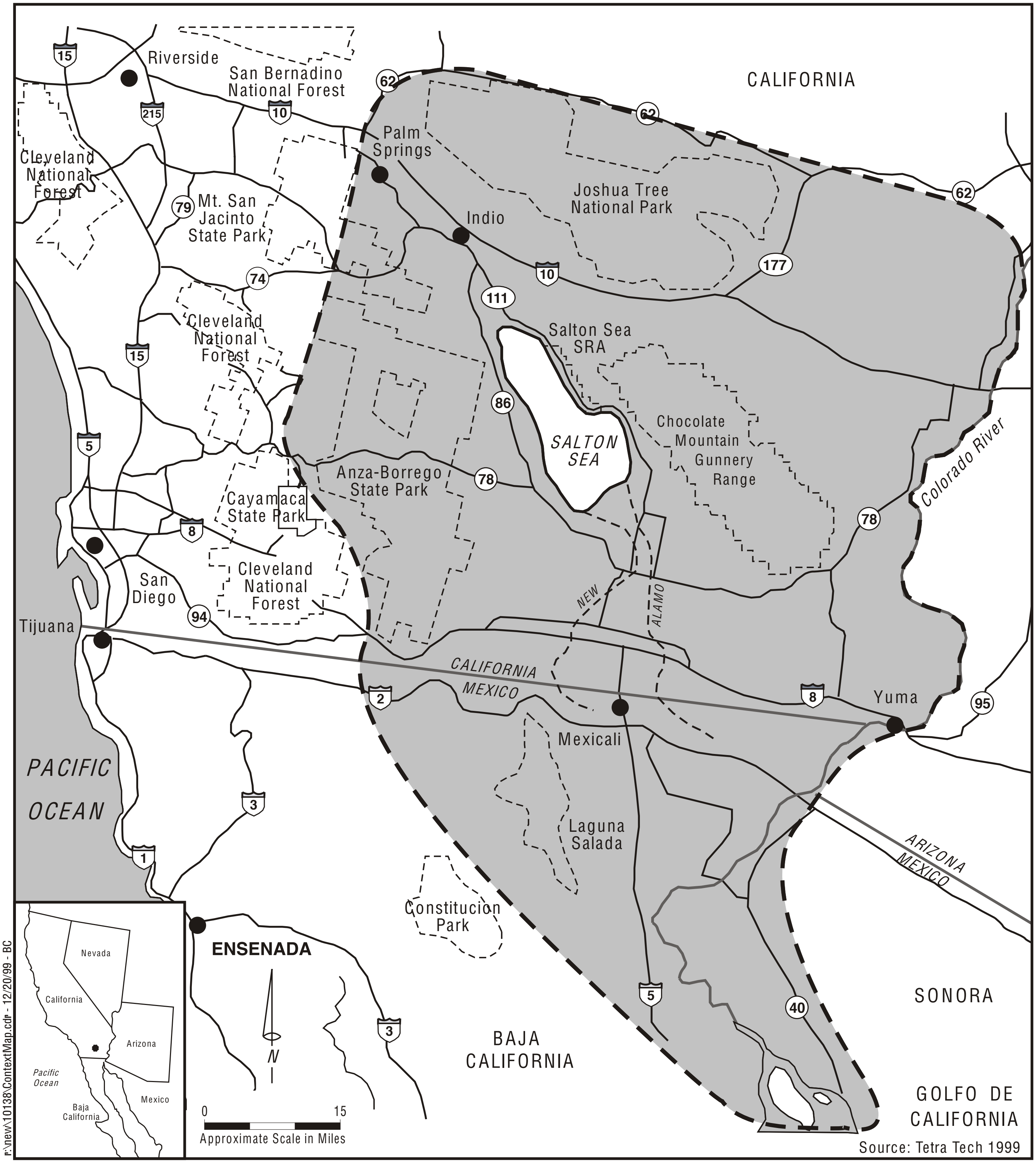
3.12.2 Regional Recreation

There is an abundance of regional recreation opportunities within the Salton Sea Phase I study area. This study area is bounded by and includes, Joshua Tree National Monument to the north, the Colorado River to the east, the northern tip of the Gulf of California to the south, and the Anza-Borrego State Park to the west (Figure 3.12-1). The study area is abundant in recreational opportunity, ranging from cultural tourism sites to thousands of miles of OHV trails. This summary of regional recreation will be divided into those areas north, east, south, and west of the Sea.

The region north of the Salton Sea includes such well known recreation areas as Palm Springs, Joshua Tree National Monument, Mecca Hills, and the San Jacinto Wilderness Area. Resort recreation mixed with natural and cultural opportunities highlight this area. The blend of these extremes has become a trademark attraction to this area of California, which varies from the typical golf/tennis resort of Palm Springs and its surrounding communities to numerous state ecological reserves, palm oases, and alpine experiences of the San Jacinto Wilderness. Some of the typical recreation activities of this region include golf, tennis, gaming, camping, hiking, interpretive walks, birding, mountain biking, auto touring, horseback riding, rock climbing and nature viewing.

Quality accommodations supporting this variety of recreational activities provide a very desirable experience and attraction factor for regional visitors.

From the Salton Sea east to the Colorado River lies thousands of square miles of open space with widely distributed recreational opportunities. The major forms of recreation within the desert portion of this region are focused on OHV use, camping, cultural touring (highlighting historic mining and water conveyance), and geologic sites touring. The highest concentration of recreational activity east of the Sea is along the Colorado River. The juxtaposition of two states, offering activities from sand dune OHV use to hiking, and a highly desirable water- oriented resource draws millions of visitors annually to this year-round playground. Some of the key recreational sites and their assorted activities include the native American ground figures "Intaglios" at Blythe and water skiing, boating, fishing, and wildlife viewing along the Colorado River near Parker, Yuma, and Picacho State Recreation Area. Active sand dunes, some of the largest in the west, including those managed by BLM at the Imperial Sand Dunes Recreational Lands, also provide popular sand OHV use and geologic discovery opportunities.



Salton Sea Regional Context Map

Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-1

The southern portion of the regional study area extends from the Sea to the northern tip of the Gulf of California, encompassing the Colorado River Delta and Laguna Salada. Recreational opportunities are more limited in this region because much of the land is agricultural. From the Sea south to the border is a consistent grid of roads and irrigation canals separating low field crops and creating a visually monotonous setting. The only developed recreational facilities in this area are Wiest Lake County Park and the Finney-Ramer Unit of the Imperial Wildlife Area. These facilities, located along the Alamo River, offer boating, fishing, and waterfowl hunting. Limited OHV opportunities exist along the east and west edges of this area on both sides of the national border with the Yuma Desert Recreation Area, the only officially designated area for this use.

Recreational opportunities occur along the Colorado River and approximately 60 miles south of the border within the river's delta, south to the northern tip of the gulf. The wetlands of Rio Hardy and Cienega de Santa Clara, combined with the intertidal marshes of the gulf, provide extensive birding and wildlife viewing opportunities. The combination of large wetlands and marshes with sport fishing near El Golfo de Santa Clara lead to the potential of attracting thousands of visitors per year. Due to the lack of visitation data available within this area of Mexico, the extent of existing use presently cannot be identified.

Lands west of the Sea to the Vallecito Mountains and Superstition Hills offer abundant recreational opportunities. Anza-Borrego Desert State Park and Ocotillo Wells State Vehicular Recreation Area are dominant recreational facilities west of the Sea. Hiking, horseback riding, mountain biking, OHV use, auto touring, and wildlife viewing are popular recreational activities in this region. When the significant annual visitor use days at Anza Borrego State Park are combined with those of Ocotillo Wells Vehicle Recreation Area, the destination value of the area is evident.

It is evident that recreation demand pressures of population growth from San Diego and San Bernardino counties, two of the fastest growing counties in the state, combined with advancing growth in western Arizona, will continue to press toward the edges of the Salton Sea. If water quality of the Sea was improved and surface elevation was stabilized, this growth would rapidly extend to its shores. This demand is intensified by the fact that the Salton Sea, the largest inland body of water in California, is in an arid region where waterborne recreation is highly desirable. The fact that the Sea is surrounded by a multitude of quality and unique recreational opportunities, to which visitors are willing to travel great distances to enjoy, speaks to the increasing demand in southern California and western Arizona for outdoor recreation facilities and areas.

3.12.3 Local Recreation Resources

Zone Analysis

- The Salton Sea has served and continues to provide for a diversity of water-associated recreation interests. Although much of the landscape and human

> uses surrounding the Salton Sea share many common features, there are distinct characteristics, existing uses, and conditions that vary from one shore edge area to the next. These distinct characteristics can be used to divide the Salton Sea into a series of zones. The physical boundaries of these zones are defined by their proximity to the Sea and extending land-side to the foot of the nearest mountain range or up to six miles from shore, depending on the location of Sea-related facilities (Figure 3.12-2).

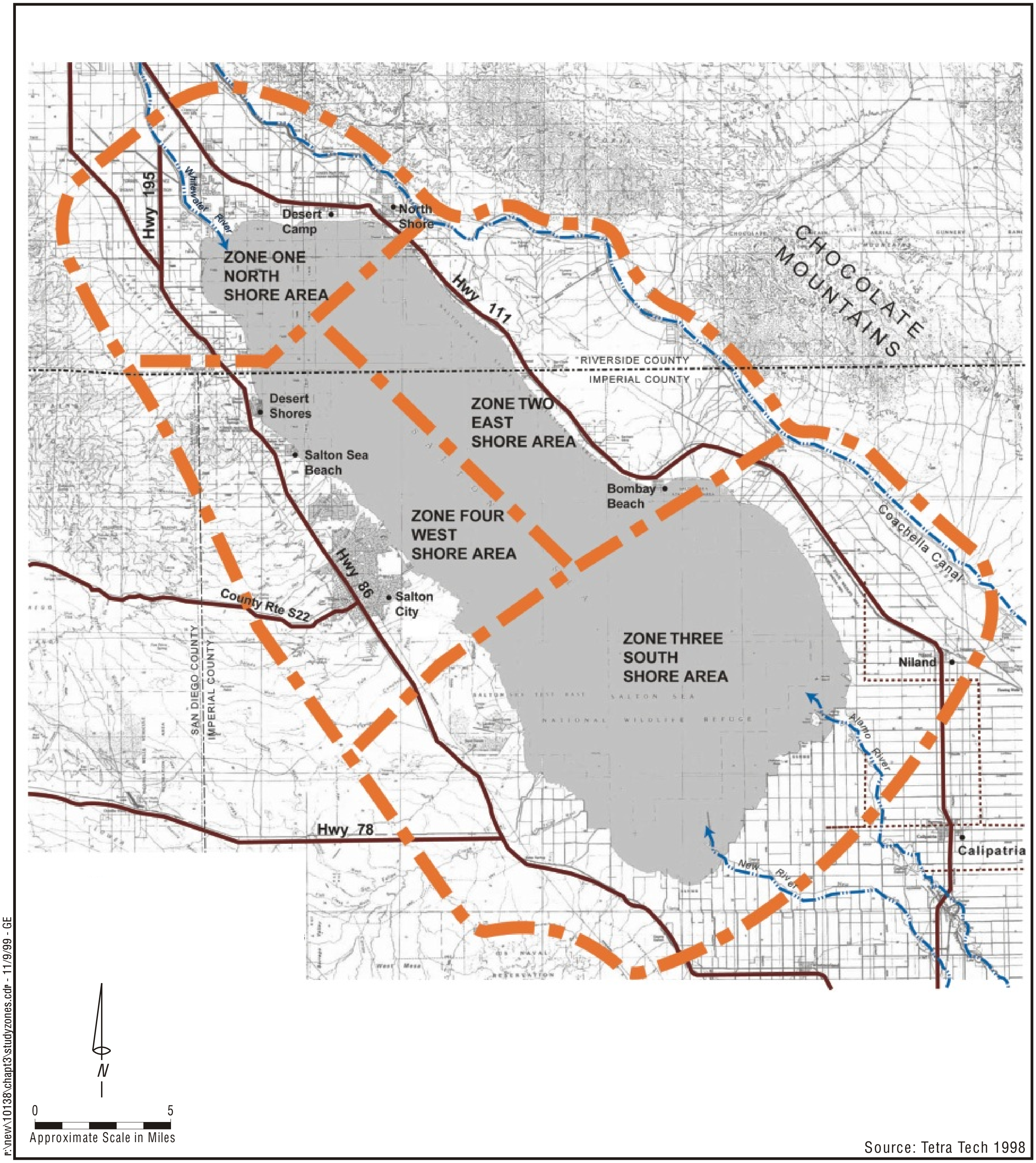
This section defines four relatively homogeneous subareas of the Salton Sea shoreline that can be described as distinct recreation zones:

- North Shore (see Figure 3.12-3);
- East Shore (see Figure 3.12-4);
- South Shore (see Figure 3.12-5); and
- West Shore (see Figure 3.12-6).

Zone One: The North Shore Area

The North Shore Area (Figure 3.12-3) includes approximately 16.5 miles of Sea shoreline and stretches from the Riverside/Imperial county boundary on the west side, just north of Desert Shores around the north perimeter of the Sea, to Desert Beach along Highway 111. The nearly flat land is mostly in private ownership, with portions falling within Torres Martinez tribal land. The land is predominantly agricultural, with well-established irrigation systems supporting intensive crop and orchard production, including citrus, date, and vineyards at the northwest corner and row crops along the northeast shoreline. Orchard crops provide scenic foreground and middle ground features for the relatively limited view opportunities to the Sea and beyond. Public roads tend to be set back from the Sea in this zone, with over a two-mile off-set on the west side, no public roads in the vicinity of the Whitewater Rivers, and approximately one-mile off-set from Highway 111 along the northeast shore.

Due to the absence of public roads and the predominance of private ownership, there is limited public access in this zone, especially in the Whitewater River and delta area. There are some developed urban uses along Highway 111 with the residential pockets of Desert Camp, North Shore, Mortmar, and Desert Beach. Numerous private duck ponds are in the delta region of the Whitewater River.



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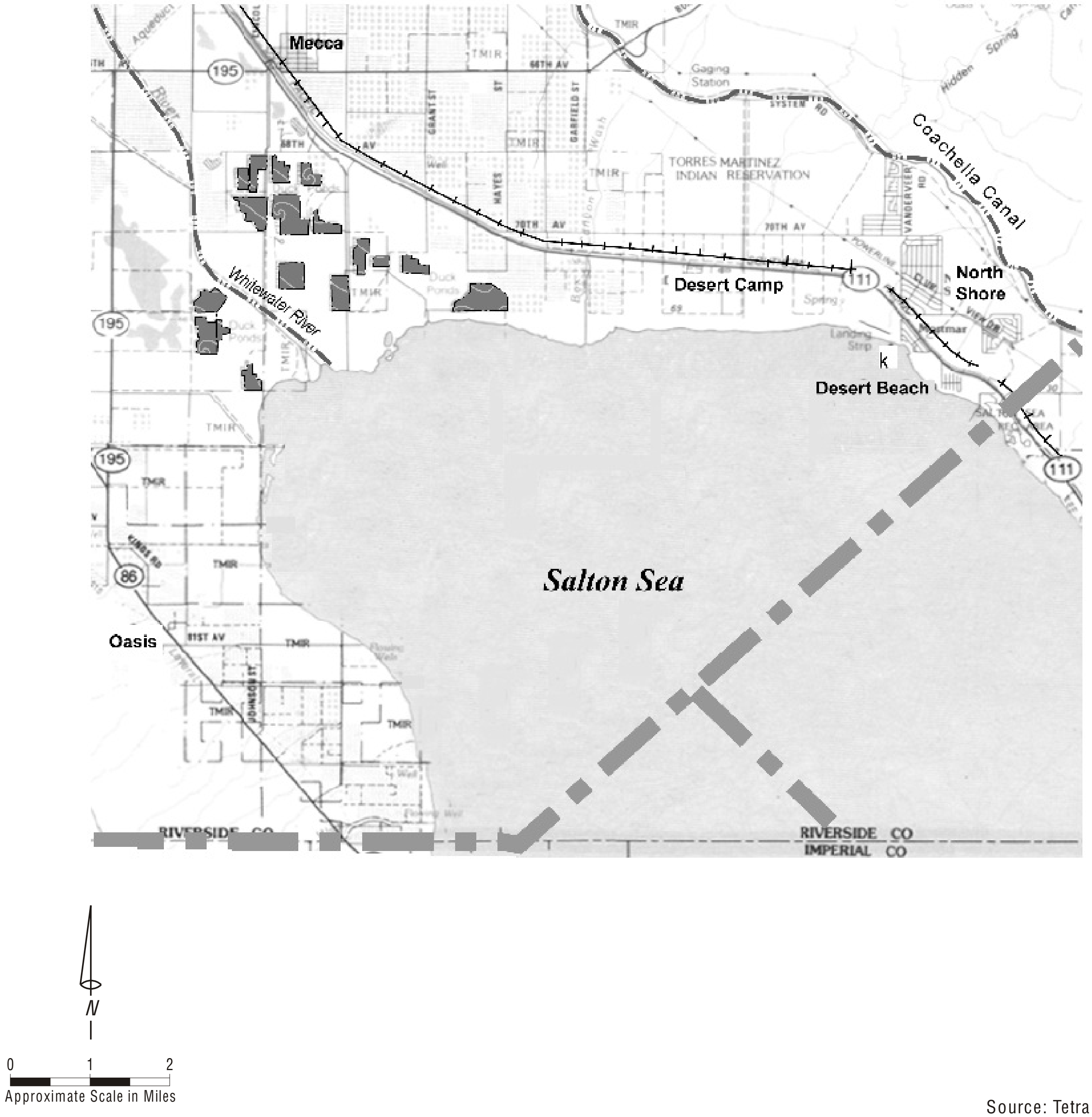
Salton Sea Study Area Study Zones

Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-2



Source: Tetra Tech 1998

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Study Zone

Duck Ponds

k Boat Ramp

Zone One Map: The North Shore Area

Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-3

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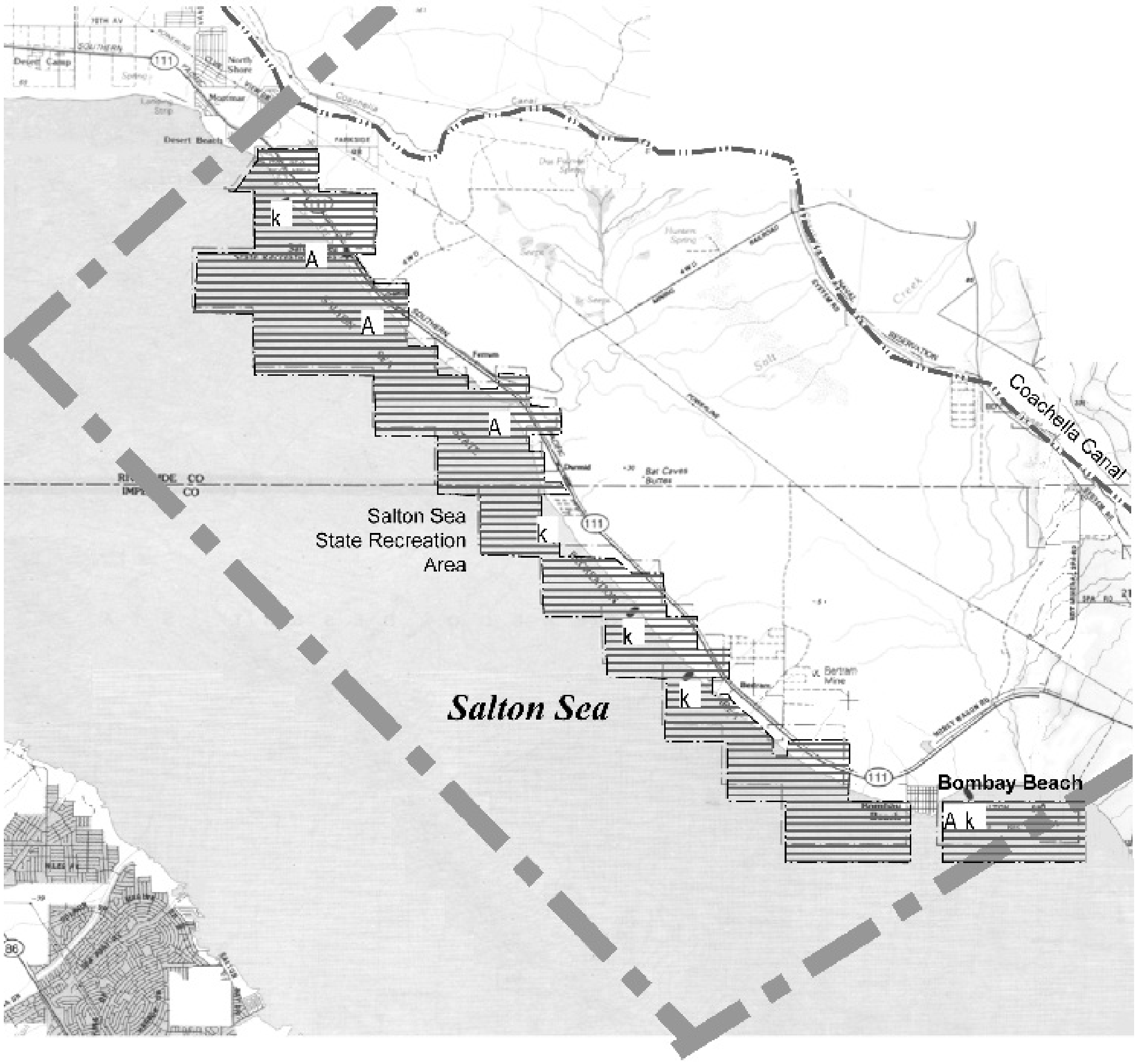

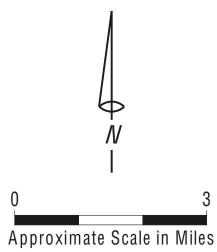

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Study Zone

State Recreation Area

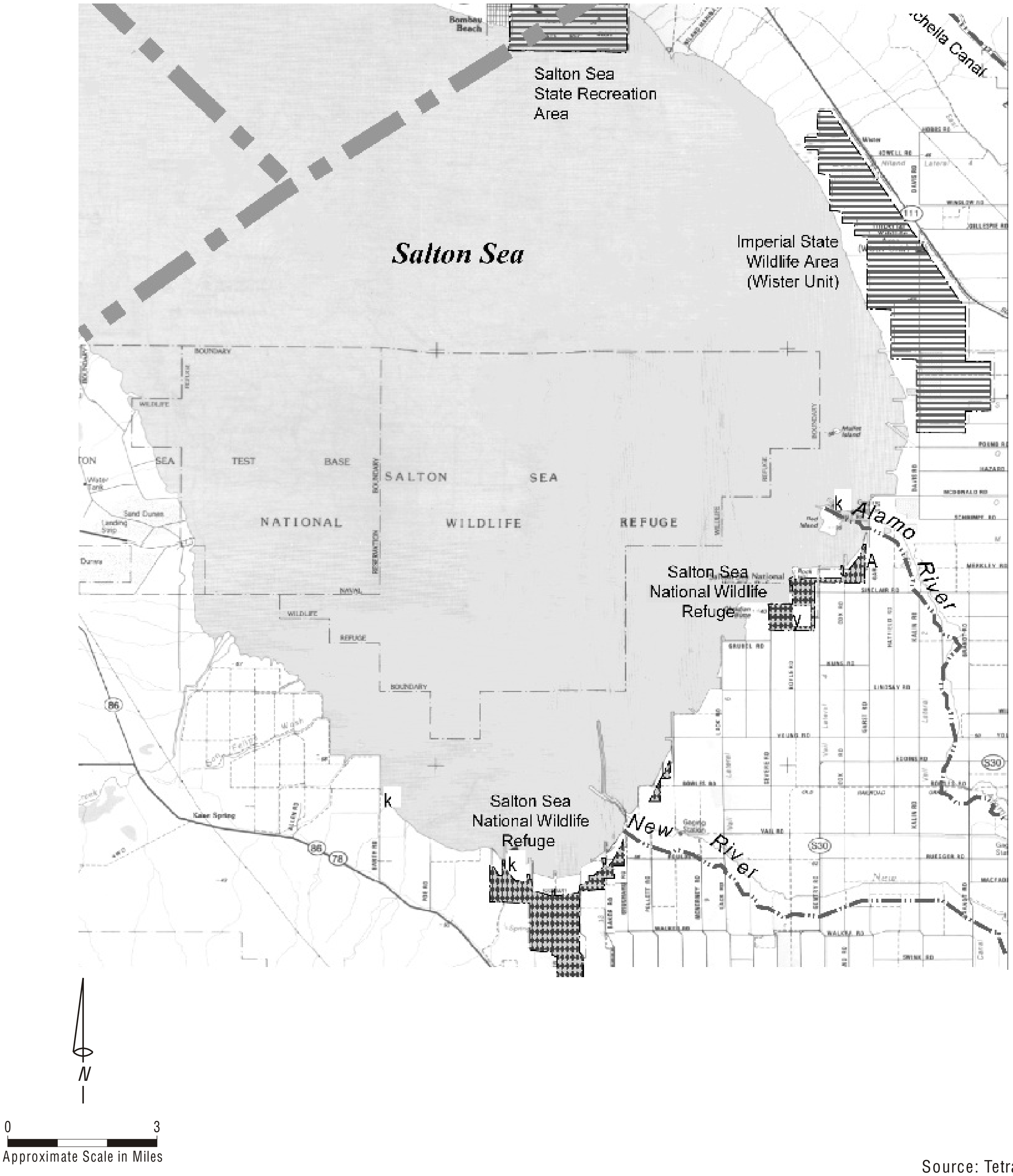
k Boat Ramp

A Camp Ground

Zone Two Map:
The East Shore Area
Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-4



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Source: Tetra Tech 1998

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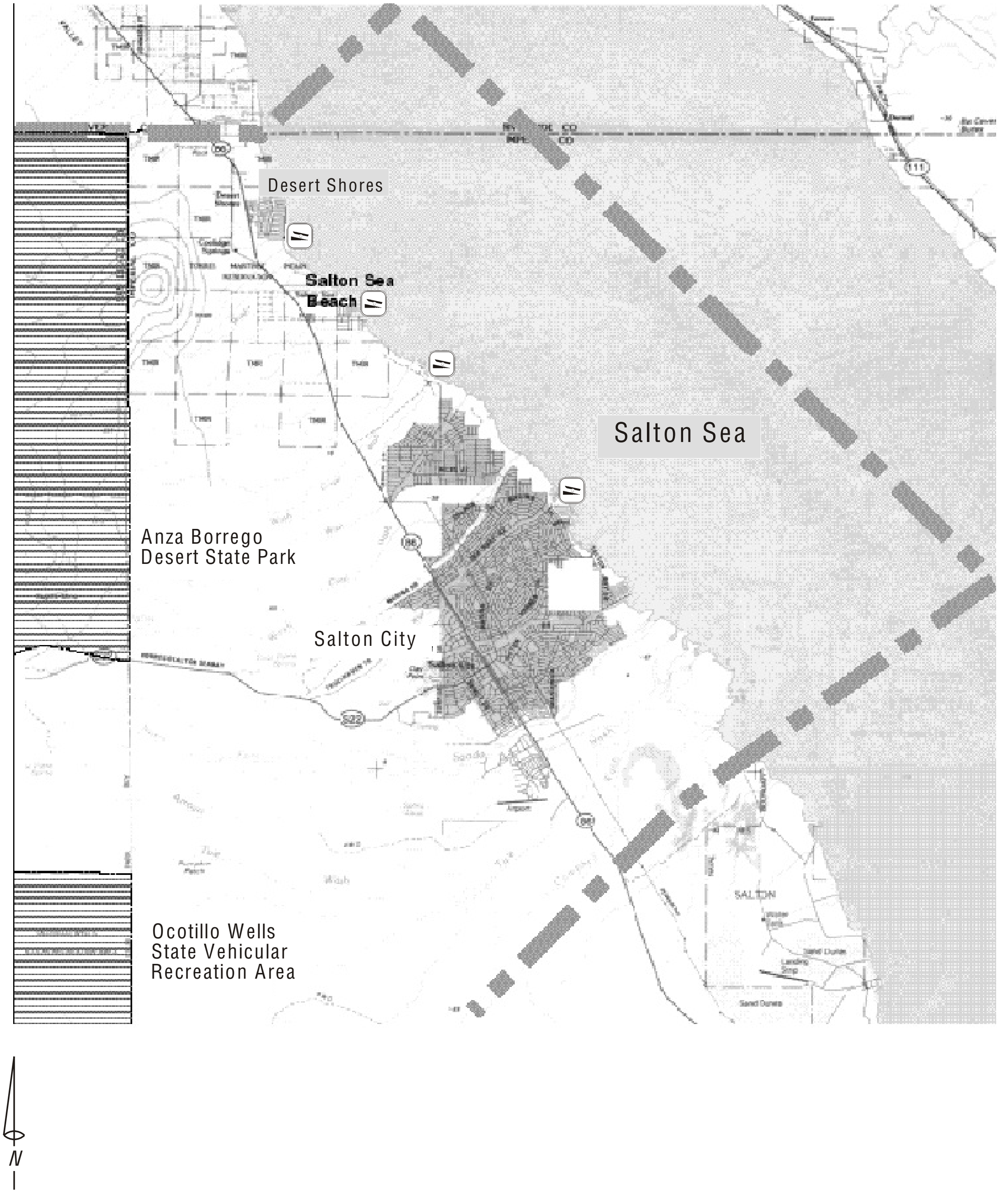
Study Zone	K Boat Ramp
Federal Lands	A Campground
State Lands	y Ranger Station

Zone Three Map: The South Shore Area

Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-5



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Study Zone

State Lands

Boat Ramp

Zone Four Map:
The West Shore Area
Salton Sea, California

Tetra Tech, Inc.

Figure 3.12-6

Relatively high levels of wildlife habitat sensitivity can be assumed for the Whitewater delta area because of its inaccessibility and the converging freshwater to saltwater biomes. A significant characteristic of this zone is its locational relationship between the Coachella Valley development thrust and the Salton Sea.

Types of recreation uses associated with the North Shore Zone include hunting at the private duck ponds, offshore fishing and boating. Under present ownership, there is limited shore-related recreation use in the North Shore Area. The intensive agricultural uses with mature orchard canopies provide both aesthetic and possible future opportunities for recreational uses, such as campgrounds or day-use areas. Wildlife habitat around Whitewater River outflow offers wildlife viewing opportunities. The prevalence of tribal lands could present recreation-related economic development opportunities.

Zone Two: The East Shore Area

The East Shore Area (Figure 3.12-4) includes approximately 17.5 miles of Sea shoreline and stretches from just east of Desert Beach at the north end to Bombay Beach at the south end along Highway 111. Geomorphically, the terrain consists of the lower alluvial plains of the Mecca Hills and the Orocopia and Chocolate mountains, with, typically, moderate gradients of one to five percent. California low desert scrub vegetation is the predominant cover for this zone, with introduced palms and exotics at some of the public use areas. Because of the proximity of Highway 111 to the Sea, low-growing desert scrub vegetation, and the relatively undifferentiated topography and gradual slopes, this zone affords wide open views of the Sea and provides the best viewing opportunities to the Sea from public lands. This zone is also the first point of visual and physical access to the Sea from the north where the major nearby population centers are located.

Resort facilities in this zone are in various stages of disrepair. The North Shore Yacht Club and Marina are unused. Sea frontage is almost entirely within state ownership, with the CDPR-operated Salton Sea State Recreation Area (SRA) being the primary presence. Thermal springs east of Highway 111 and north of Frink are used for recreational/health purposes. Habitat sensitivity is assumed to be lower than portions of Zone One due to less extensive riparian vegetation and greater public access. Both Sea-related and California low desert-associated habitats can be considered sensitive.

Recreation uses associated with the East Shore Area include camping, RV camping, power boating, sailing, PWC windsurfing, shore fishing, boat fishing, and sunbathing. The Salton Sea SRA offers the most extensive public access and use of the Sea, with a total of approximately 1,400 campsites. The headquarters area provides 15 full hook-up sites, 25 developed campsites, and restrooms with electricity, running water, and hot showers. Mecca Beach campground provides four full hook-up sites, 109 developed campsites, and restrooms with electricity, running water, and solar showers. The three remaining campgrounds provide primitive camping with chemical toilets and water. There are boat launching and mooring facilities at each of the five campgrounds. The facility headquarters includes the additional features of a visitor center and day-use area. A day-use beach is at the northern end of the area.

Records of public use of the Salton Sea SRA, including total numbers of visitors, total revenue, and spending per visitor, have been kept since 1972. Prior to official recording of the economic statistics, park staff estimated the historic peak seasonal use of the unit was approximately 660,000 visitors in 1961-62. Although recorded peak years for both visitation and revenue occurred in the early 1980s (Table 3.12-1), the last three years reveal evidence of a resurgence in public attendance, with a doubling of the total number of visitors in that period.

Table 3.12-1
Salton Sea State Recreation Area Visitation Data

Fiscal Year	Annual Visitation	Total Revenue	Spending per Visitor
1972-73	180,086	$ 74,850	$ 0.42
1973-74	179,304	$ 64,532	$ 0.36
1974-75	228,204	$ 63,436	$ 0.28
1975-76	174,156	$ 80,543	$ 0.46
1976-77	221,454	$ 100,406	$ 0.45
1977-78	207,149	$ 93,126	$ 0.45
1978-79	214,141	$ 93,418	$ 0.44
1979-80	209,724	$ 105,022	$ 0.50
1980-81	330,828	$ 168,623	$ 0.51
1981-82	394,552	$ 231,057	$ 0.59
1982-83	382,441	$ 250,158	$ 0.65
1983-84	328,902	$ 236,661	$ 0.72
1984-85	232,691	$ 206,236	$ 0.89
1985-86	261,889	$ 200,462	$ 0.77
1986-87	276,401	$ 186,160	$ 0.67
1987-88	160,285	$ 185,126	$ 1.15
1988-89	183,359	$ 164,538	$ 0.90
1989-90	175,368	$ 155,740	$ 0.89
1990-91	134,779	$ 103,223	$ 0.77
1991-92	114,297	$ 98,345	$ 0.86
1992-93	90,996	$ 87,124	$ 0.96
1993-94	87,369	$ 83,451	$ 0.96
1994-95	87,586	$ 84,124	$ 0.96
1995-96	139,013	$ 91,279	$ 0.66
1996-97	203,272	$ 99,003	$ 0.49
1997-98	250,000	$ 130,280	$ 0.52
1998-99	275,000	$ 130,000	$ 0.47
		$ 3,566,923	**$ 0.62**

Private recreation facilities within this zone all show evidence of deferred maintenance and were nonoperational at the time of this field inventory. Bombay Beach**,** a recreation residential pocket of around 150 trailers, has been effectively cut off from the Sea due to the construction of a levee structure surrounding the residential area.

Although evidence of some needed repair exists, the recreation area is still quite functional and attractive to visitors. Sea elevation rise has caused problems with some of the facilities and with such elements as paving, picnic tables, and landscaped areas. One potential opportunity cited by park staff would be a shift in emphasis to increased enhancement of interpretive-oriented facilities, such as wildlife viewing facilities (blinds), natural history, and historically focused interpretive elements. Sea level stabilization also would allow the state to apply for funding to begin improving boating facilities. Improvements for private recreation facilities within this zone are assumed to be linked with stabilized Sea elevations and improved water quality.

Zone Three: The South Shore Area

The South Shore Area (Figure 3.12-5) includes approximately 41.3 miles of Sea shoreline and stretches from the Imperial County Niland facility area on the east side around the southern perimeter to just north of the Navy's Salton Sea Test Base on the southwest side of the Sea. The nearly flat land is fairly evenly divided between public and private ownership. Public lands can be grouped into three categories, state-owned and operated lands, such as the Imperial County Wildlife Area-Wister Unit, and federal lands split between the Sonny Bono Salton Sea National Wildlife Refuge, operated by the USFWS, and the Navy's Salton Sea Test Base. The Salton Sea Test Base has been decommissioned and is being conveyed to other federal agencies for management.

The Salton Sea southern shore comprises the northern reach of the intensive Imperial Valley agricultural area. Irrigation water and drainage from the New River and the Alamo River result in a substantial freshwater riparian zone between the Sea and surrounding agricultural lands, resulting in the most extensive and rich wildlife habitat area of the Salton Sea. The greatest levels of wildlife habitat sensitivity occur in this zone of the Sea. Other uses found in this zone, in addition to the agricultural and preserve areas, include geothermal hydroelectric facilities that, because of their vertical scale, tend to dominate the agricultural landscape. Public roads tend to be set back from the Sea in this zone, with typical setbacks of two or more miles on the west side, one or more miles offset adjoining the Imperial Wildlife Unit, and very limited public roads along the southeastern margin of the sea. Obsidian Butte, Red Island, and Mullet Island, unique volcanic-related landforms along the southeast margin, are in striking contrast with the predominantly flat landscape surrounding the Sea. The Imperial County recreation facility has been entirely abandoned due to rising water levels.

The types of recreation uses occurring in the South Shore Zone are strongly linked with the wildlife values associated with this area and include hunting, shore and boat fishing, boating, and wildlife viewing. The State Imperial Wildlife Area, operated by the CDFG, has been maintained as a hunting, fishing, and passive recreation use area for close to 50 years. Records kept since 1962 of the number of hunters and birds taken show a fairly constant pattern of usage (Table 3.12-2). The peak year for hunters occurred in the 1970-1971 season, with 10,547 hunters registering that year. The lowest usage occurred during the 1992-1993 season, with 5,302 registered hunters.

The Sonny Bono Salton Sea National Wildlife Refuge consists of approximately 36,000 acres, 34,250 of which are inundated by the Sea, leaving 1,750 acres of agricultural fields, freshwater marsh, and riparian lands. This refuge is considered one of the premier wildlife habitats along the Pacific Flyway, with over 400 bird species recorded. Observation towers, viewing blinds, observation trails, and an interpretive center have been developed to facilitate public use of these resources. The prime season for wildlife viewing runs from October to March.

The Salton Sea Navy Test Base consists of 21,587 acres of land, two thirds of which is submerged by the Sea. Unlike the other portions of Zone Three, vegetation on this property is characterized by California low desert scrub (creosote, sage, and prosopis). A large area of active sand dunes covers much of the property. Numerous remnant structures, roads, and utilities remain on the property. The area has relatively high habitat values.

Zone Four: The West Shore Area

The West Shore Area (Figure 3.12-6) includes 15 miles of shoreline from north of the Naval Test Base to the intersection of the Riverside, San Diego, and Imperial county lines. Extending west to the base of the Santa Rosa Mountains and paralleling Highway 86, this zone includes most of the residential development around the Sea (Figure 3.12-6). Topography of this portion of the shore is a gradually sloping alluvial fan between the Sea and the boundary to Anza-Borrego State Park. Most of properties within Zone Four are privately owned, with checkerboard sections of land to the north owned by the Torres Martinez tribe, interspersed with private agriculture. Undeveloped residential lots appear on many maps but are identified on the ground only by the roads and utilities servicing them. Views of the Chocolate Mountains across the Sea and the Santa Rosa Mountains to the west provide exceptional displays with changing light. Extending from Salton City to Borrego Springs, State Route 22 is a major recreational corridor to the Sea.

This portion of the shore is critical to support the existing level of sport fishing on the Sea. Public access to the shore can be attained via some dirt roads, but most of the recreating public uses the four boat ramps located in the varied communities within this zone. Residential development within this zone is the highest quality

Table 3.12-2
Imperial Wildlife Area Waterfowl Hunting Profile

Period	Number of Hunters	Number of Ducks	Number of Geese	Number of Coots	Other Birds	Total Birds Shot	Average Take
1961-62	5,357	7,294	1,130	207	630	9,261	1.73
1962-63	4,779	5,072	1,290	265	0	6,627	1.39
1963-64	5,431	6,969	1,061	177	0	8,207	1.51
1964-65	6,074	10,834	1,466	172	0	12,472	2.05
1965-66							
1966-67	8,815	12,614	5,890	261	0	18,765	2.13
1967-68	8,423	12,714	1,633	292	0	14,639	1.74
1968-69	7,280	8,506	1,286	357	0	10,149	1.39
1969-70	8,169	14,294	894	474	0	15,662	1.92
1970-71	10,547	15,093	5,808	488	0	21,389	2.03
1971-72	9,800	14,603	3,123	394	0	18,120	1.85
1972-73	10,676	16,018	2,110	448	0	18,576	1.74
1973-74	10,937	8,940	5,672	283	0	14,895	1.36
1974-75	10,206	17,720	989	570	0	19,279	1.89
1975-76	10,927	19,125	3,716	501	0	23,342	2.14
1976-77	8,565	13,758	5,416	135	0	19,309	2.25
1977-78	9,041	9,467	2,692	69	0	12,228	1.35
1978-79	8,793	17,995	575	116	0	18,686	2.13
1979-80	8,881	16,492	653	120	0	17,265	1.94
1980-81	7,711	8,510	950	181	0	9,641	1.25
1981-82	8,621	13,323	1,617	200	0	15,140	1.76
1982-83	9,327	13,736	678	157	0	14,571	1.56
1983-84	8,731	7,626	1,679	155	0	9,460	1.08
1984-85	8,853	6,744	3,177	77	0	9,998	1.13
1985-86	8,969	10,808	2,273	105	0	13,186	1.47
1986-87	8,919	12,636	819	105	0	13,560	1.52
1987-88	7,995	15,084	1,218	76	0	16,378	2.05
1988-89	6,107	4,894	2,253	13	0	7,160	1.17
1989-90	6,166	5,763	1,253	46	0	7,062	1.15
1990-91	6,432	7,849	2,211	65	0	10,125	1.57
1991-92	5,835	5,641	932	53	0	6,626	1.14
1992-93	5,302	5,466	913	55	0	6,434	1.21
1994-95	6,774	10,088	2,857	85	0	13,030	1.92
1995-96	7,627	9,675	1,380	106	0	11,161	1.46
1996-97	7,870	11,554	1,505	160	0	13,219	1.68
1997-98	8,187	14,880	1,317	37	0	16,234	1.98
1998-99	8,141	12,468	2,811	54	0	15,333	1.88
Total	**290,268**	**404,253**	**75,247**	**7,059**		**487,189**	**1.68**

around the Sea. There is a potential, assuming infrastructure needs are met, for the development of approximately 20,000 residential lots within this zone. With the adjacency to both the southern Coachella Valley and Borrego Springs, this area of the Sea seems the most suitable location for shore development. Other than a few small shoreline nature trails, there are no significant wildlife viewing areas within this zone, nor is there significant habitat. The most significant characteristic of this portion of the Salton Sea is its existing and potential for land-based support facilities of waterborne recreation. With the existing infrastructure and location away from sensitive wildlife habitat, the communities of Desert Shores, Salton Sea Beach, and Salton City provide the basis for needed recreational facility redevelopment.

The types of recreation associated with this zone include recreation rental housing, RV camping, shore fishing, boating (boat launching), sport fishing, sunbathing, hiking, and bird watching. Desert Shores, Salton Sea Beach, and Salton City all provide RV camping adjacent to the boat launching facilities and marinas within their respective communities. The few motels and RV campgrounds in the three major communities also provide accommodations for birders in early spring.

The remnants of closed and dilapidated resorts and restaurants from the height of the area's popularity have a tendency to give a negative impression to visitors. This zone of the Sea is very tourist dependent, which will be hurt if water quality and surface elevation stability are not improved in the short term. There is excellent potential for this area, above all others around the shore, for an enormous growth in recreation visitation and possible influx of private capital. The west shore has the beginnings of support facilities for recreation and marinas, which are critically needed if situations improve to their 1960s levels.

3.13 VISUAL RESOURCES AND ODORS

3.13.1 Introduction

This affected environment discussion includes visual resources and the olfactory character of the area (odors). The Phase 1 study area for visual resources and odors encompasses most of the Salton Basin. The effects would be of most concern in areas that are populated or that receive a high amount of use, areas with adjacent sensitive uses, areas that attract sensitive users (e.g., recreational areas), and areas of public or special interest (e.g., areas of local concern or wilderness areas).

The BLM Visual Resource Inventory Manual H-8410-1 provides a visual resource management (VRM) methodology for evaluating the visual resources for BLM lands. For consistency sake, the visual resources of public lands managed by BLM and additional project lands affected by the proposed alternatives will be evaluated using the VRM methodology. According to the VRM, the scenic visual resources in an area are defined by scenic quality, viewer sensitivity, and viewer distance zones.

Based on these three factors, BLM and project area lands are placed in one of four visual resource inventory classes. Visual resource inventory classes are assigned to public lands as an inventory tool that portrays the relative value of the visual resources and as a management tool that portrays the visual management objectives. For example, Class I is assigned to national wilderness areas and other administratively designated areas where management decisions have been made to maintain a natural landscape. Classes II, III, and IV are assigned based on a combination of scenic quality, sensitivity level, and distance zones. Classes I and II are the most valued, Class III represents moderate value, and Class IV is least valued.

BLM conducted a visual resource inventory of federal lands surrounding the Salton Sea. This evaluation included a determination of scenic quality sensitivity levels and distance zones and led to the establishment of VRM management classes. BLM recognizes that the Salton Sea Basin has important scenic qualities and has categorized various parts of the basin in terms of VRM Objective Classes I through IV, with Class I being the most pristine and subject to the highest level of visual protection. Classes II through IV allow progressively higher levels of visual modification to the landscape.

The areas immediately west and east of Salton Sea, where the proposed Phase 1 facilities associated with the restoration project would be located, have been classified as VRM Class II. This classification provides the primary directive for the evaluation of design, construction, and operation activities for the proposed project.

(***Note to Reviewers***: *The Class II VRM for the Salton Sea Basin is an interim unofficial designation that is highly conservative but is assumed for purposes of completing the draft impact analysis. Tetra Tech is awaiting receipt of official BLM VRM classifications for the Salton Sea Basin from the El Centro BLM Office. Therefore, the conclusions presented in the impact analysis in Chapter 4 are preliminary and subject to change.*)

The specific objective for the Class II VRM is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. A proposed project may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

3.13.2 Visual Resources—Salton Sea Basin

Landforms, water surfaces, vegetation, color, adjacent scenery, scarcity, and cultural modifications (i.e., engineered features) make up the visual aspects of an area or project and determine the visual character and the manner in which it is viewed. The Salton Basin is visually characterized by desert landscapes, ranging from sparsely vegetated, gently sloping alluvial terrain surrounding the Sea, to sandy and broken rock hills on the perimeter of the basin. Unique within the desert landscape is the Sea itself, which provides a scenic combination of open water against a background of desert and mountains.

Major viewing areas near the Sea include public travel routes (primarily state routes 86 and 111), nearby residential and commercial areas, such as the communities of North Shore, Bombay Beach, Niland, Salton City, Salton Sea Beach, and Desert Shores, and public use areas, such as parks and recreation areas. Major recreation attractions include the Salton Sea SRA, developed along 20 miles of the northeastern shoreline by the California Department of Parks and Recreation, and the Sonny Bono Salton Sea National Wildlife Refuge at the southern end of the Sea. Recreation facilities also are available at other public areas and at commercial marinas and residential-recreational communities around the Sea.

Visual Characteristics

The area bordering the Salton Sea to the north is a gently sloping alluvial plain dominated by intensive high-value agriculture. The area is characterized by small plots of land containing crops of differing color, height, texture, and spacing, such as date palms and vineyards. The Orocopia Mountains are northeast of the Sea. A two-lane highway, State Route 111, follows the shoreline of the Sea south of Mecca along the eastern boundary to Niland.

Moving south along State Route 111, the landscape to the east is first sheltered from the wind by eastern mountain ranges and then becomes more rugged and desolate. The northwest trending and steeply sloped Chocolate Mountains, so named because of their dark color, lie between five and ten miles east of the Sea from just north of the county line south to Niland. The terrain is arid, and natural erosion has formed ravines carrying debris, such as rock, from the mountains toward the Sea. A railroad runs parallel to Highway 111 along the east side of the Sea, and farther east a high-voltage powerline runs from northwest to southeast. The Coachella Canal runs along the base of the mountains, paralleling the Sea and the highway.

The Salton Sea SRA is between the highway and the Sea from south of North Shore to Bombay Beach. The park is highly developed, with camping and recreational uses to the north, becoming less developed to the south. The town of Bombay Beach, located on the Sea at the point where the highway turns eastward, contains a dense cluster of mainly seasonal residences and a small number of commercial establishments. From south of Bombay Beach the highway becomes increasingly distant from the Sea, and smaller routes lead to the shoreline.

The area south of the Salton Sea is a northward-sloping wide open valley supporting large fields of intensive commercial agriculture. Two rivers that terminate in the Sea, the Alamo River and the New River, are deeply incised in the alluvial slope. Large tracts of irrigated farmland are bordered by irrigation and drainage ditches. The tracts form a patchwork of fields planted with crops of similar size and spacing but with differing color and texture. Because the terrain is so flat, elevated structures, such as silos, tend to dominate the viewshed. Geothermal plants near the mouths of the Alamo and New rivers are dominant features of the landscape because of their height and because their steam plumes provide a stark contrast to the blue skies characteristic of the region.

The four-lane State Route 86 is the predominant viewing area on the western side of the Salton Sea; the highway begins paralleling the Sea at its southern tip. Agriculture continues as the predominant land use southwest of the Sea. Melon and vegetable fields alternate with fields of grains and grasses up to the inactive Salton Sea Test Base site. The Vallecito and then the Santa Rosa mountain ranges are visible west of the Sea, trending closer as they progress north. The Sonny Bono Salton Sea National Wildlife Refuge, located in the southern part of the Sea, contains some artificial landscaping and ponds designed to benefit the waterfowl and other birds that inhabit and traverse the refuge.

The Salton Sea Test Base contains a limited amount of pre-World War II style architecture, although most was demolished to the foundation when the base closed. Cultural artifacts and some local topography in the form of sand dunes are on the test base. As with other areas of the Sea, remnants of marinas and wharf structures can be seen partially submerged in the Sea, illustrating the rising water level.

The permanent communities of Salton City, Salton Sea Beach, and Desert Shores lie along State Route 86 starting at the midpoint of the western side of the Salton Sea and following the shoreline north. These communities contain the highest amount of residential and commercial development found around the Sea. Marinas and other private recreational facilities are visible along the shoreline of the Sea. Desert vegetation replaces agricultural fields from the test base to Desert Shores, north of which are some high value fields on both sides of Highway 86.

The Torres Martinez Indian Reservation occupies the northwest corner of the Salton Sea. This economically depressed area is characterized by subsistence uses, such as small garden plots and small fenced areas, with a few livestock and farm animals.

Regulatory Considerations

The Riverside County Comprehensive General Plan and Imperial County General Plan contain objectives regarding scenic highways and the preservation of visual resources.

The Riverside County Comprehensive General Plan contains the following scenic highway objectives:

- Promote the establishment of Official and Eligible State and County Scenic Highways and Corridors.
- Design development within designated scenic highway corridors to maximize the compatible multi-purpose objectives of open space and urban planning.

The Imperial County General Plan recognizes the Salton Sea as an important visual resource in the county. The guidelines for preserving visual resources are as follows.

- Goal 7: The aesthetic character of the region shall be protected and enhanced to provide a pleasing environment for residential, commercial, recreational, and tourist activity.

- Objective 7.1: Encourage the preservation and enhancement of the natural beauty of the desert and mountain landscape.

State Route 111, which runs parallel to the northeast shoreline of Salton Sea, is a state-designated scenic highway, included in the "Master Plan of State Highways Eligible for Official Scenic Highway Designation" (Abraham, M., August 13, 1999, personal communication; Imperial County, 1997). The portion of State Route 111 designated as a scenic highway stretches from Bombay Beach to the Imperial County line. The contrast between the flat wide Salton Sea, with its sandy beach, and the rugged rise of the Chocolate Mountains becomes apparent as one travels along State Route 111.

3.13.3 Site-specific Visual Resources

The following descriptions characterize the scenic quality of the Phase 1 project area where changes to the visual landscape would occur.

Proposed Site for Evaporation Ponds and Pupfish Pond. The location of the proposed evaporation ponds would be near the following areas (in order, from north to south): Salton City, Salton Sea Test Base, and a strip of land east of State Route 86, which begins from the base and continues for approximately 20 miles to the southern tip of the Sea.

Salton City, located along State Route 86, is a small residential community with a small number of residential houses scattered throughout the area. Views to the east include the Sea in the foreground and middle ground and the Orocopia and Chocolate mountains in the background. Views to the northwest include the Santa Rosa Mountains. Desert vegetation dominates the area. Predominant colors in the landscape are beige and green. The landform of Salton City is generally flat.

South of Salton City, along State Route 86, is the closed Salton Sea Test Base, which includes uneven topography of dunes and gullies, abandoned building foundations, elevated viewing mounds, and an abandoned dirt airstrip. Views to the east include the Sea in the foreground and middle ground and the Orocopia and Chocolate mountains in the background. Views to the northwest include the Santa Rosa Mountains. Desert vegetation is uneven, course, and low, with varying shades of beige and green that dominate the landscape. Between State Route 86 and the Salton Sea shoreline, the land gently slopes eastward toward the Sea.

South of the Salton Sea Test Base, between the Sea's shoreline and State Route 86, the predominant land use is agriculture. Melon and vegetable fields alternate with grain and grass fields up to the southern boundary of the Salton Sea Test Base site. Views are similar to both the test base and Salton City. Between State Route 86 and the Salton Sea shoreline, the land gently slopes eastward to the Sea's shoreline. Views to the south include Superstition Hills.

Proposed Site for Displacement Dike. The displacement dike would be located along the southern shore of the Sea, between the New and Alamo rivers. It would extend from the shoreline into the Sea, exposing land currently submerged. The area is within the Sonny Bono Salton Sea National Wildlife Refuge and is used by a variety of birds for feeding, nesting and roosting.

Proposed Site for EES north of Bombay Beach. Project area lands north of Bombay Beach are characterized by a relatively wide, bowl-shaped expanse of land framed by the rugged Chocolate Mountains to the east. The terrain is arid. Vegetation in this area includes predominantly low shrubs that grow in an uneven pattern. Colors in this area, attributed to both the vegetation and desert sand in the foreground and middle ground and the Chocolate Mountains in the background, are warm beiges and browns. Cultural modifications in this area include a powerline, which bisects the middle portion of the project area, and the Coachella Canal, which runs parallel and approximately four to five miles east of the powerline.

Proposed Site for North Wetland Habitat.. The North Wetland Habitat would be located adjacent to and include portions of the Torres Martinez reservation lands on the north end of the Sea. The area is currently characterized by seasonally flooded and submerged shallow areas, includes the mouth of the Whitewater River, and is the most significant shorebird habitat in the northern portion of the Salton Sea. This area also provides more snag habitat for nesting and roosting than any other area of the Sea.

3.13.4 Odors

Odors are a social factor that can negatively affect the desirability of the Salton Sea as an area to visit, to recreate, or to reside. Odors associated with the Salton Sea are a result of water quality, nutrient levels, and other biological factors, which are discussed in other sections of this document. Most drainage into the Salton Sea originates at the Colorado River, where waters are diverted westward through canals to the Coachella and Imperial valleys for irrigating agricultural lands. Approximately one fifth of this irrigation water ultimately drains into the Salton Sea (US DOI, Federal Water Quality Administration, Pacific Southwest Region, Salton Sea, California, Water Quality and Ecological Management Considerations 1970).

Salton Sea odors occur primarily as a result of decaying organic matter. The Salton Sea is characterized by an overabundance of nutrients, primarily from irrigation runoff, that produce eutrophic conditions and results in phytoplankton blooms. Phytoplankton are floating microscopic plants that exist in the upper levels of the Sea. In large abundance, these microorganisms die and decompose, resulting in the production of obnoxious odors over extensive areas of the Sea (US DOI, Federal Water Quality Administration, Pacific Southwest Region, Salton Sea, California, Water Quality and Ecological Management Considerations 1970). This problem is most prevalent in the summer months, when freshwater feeds to the Sea are at a low and temperatures are at a high. Compounding this problem are high sulfates and other compounds of the saline Sea.

Phytoplankton blooms are partially responsible for another source of odors at the Salton Sea, fish and bird kills. Beginning in the 1980s, as elevation and salinity of the lake were rising, the fishery began to decline, periodic algal blooms occurred, and die-offs of both fish and birds began to occur. During the past several years, large die-offs of fish (tens of thousands) have occurred periodically. For instance, in 1997 large die-off events occurred in January, August, and September. Bird die-offs, some caused by Type C avian-botulism, avian cholera, and Newcastle disease, have affected at least one-fifth of the approximately 400 species that frequent the area. These episodic die-offs result in unpleasant odors as the fish and birds decompose on the shoreline, releasing biogases high in hydrogen sulfide.

Odors associated with blooms and die-offs are most common on the south and east sides of the Sea, though they can occur anywhere at anytime. Odors are most prevalent and intense during the summer when temperatures are elevated and prevailing winds are out of the southeast. The predominant wind direction is from the west during the remainder of the year; overall, dominant wind directions are west, west-southwest, west-northwest, and southeast. High winds occur most frequently between April and May.

3.14 PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS

3.14.1 Introduction

The affected environment discussion for public health and environmental hazards includes an overview of public health issues and individual sections addressing biological pathogens, mosquito-borne diseases, and chemical hazards.

3.14.2 Overview of Public Health Issues

For a potential public health hazard to exist, there must be a source, a pathway of exposure, and humans must have contact with the source. For an actual public health hazard to exist, humans must be exposed to a level of the source agent that is capable of creating adverse health effects. Agents that cause disease are referred to as pathogens. A general description of the pathways of exposure and exposed populations is presented below. The pathways and populations relevant to specific disease agents or pathogens are described in the sections discussing those specific agents.

There are six general pathways of exposure that may exist at the Salton Sea: inhalation, dermal (skin) contact, ingestion, vectors, trauma, and physiological stress. Inhalation exposure to agents can occur as a result of airborne particles from wind erosion of land surfaces, aerosols of surface waters and close contact with materials laden with disease agents. Dermal exposure to agents can result from physical contact with substrates having the disease agents at the surface being contacted (water, soil, animal, surface areas, etc.). Ingestion exposure involves the intake of the disease agent in food or water. Vectors transmit disease to humans via bites. Mosquitoes are the primary insect disease vectors of concern at the Salton Sea. Other vector-transmitted disease include venomous reptiles and animal bites. Trauma involves injury or death associated with contract with objects and things in a manner that creates physical injury. The final category of physiological stress is associated with such factors as heat stroke and dehydration due to climatic conditions.

The primary populations that could be exposed to disease agents at the Sea via these existing pathways include residents, recreationists, and people employed at the Sea. Recreationists include anglers, hunters, waterskiers, and swimmers. Employees include researchers studying the Sea and employees at the various recreation areas as well as workers associated with various construction activities. In addition, residents and visitors could be exposed to disease-carrying mosquitoes that breed along the shoreline.

While there have been numerous concerns raised regarding potential public health and environmental hazards within the Salton Sea Basin, this section focuses on those known and potential hazards that are of concern to public health agencies and those that could be affected by implementing the Salton Sea Restoration Program. Chemical and biological contaminants that do not threaten public health but that affect water quality or threaten the health of fish and wildlife are discussed in separate sections.

There are a number of agents and diseases that may be perceived as public heath threats but for the reasons discussed below are not generally accepted as threats. Avian botulism is a disease caused by Type C avian botulism and is one of the main causes of bird deaths at the Salton Sea. Avian botulism is a different disease than the botulism that affects humans, and humans are generally considered resistant to Type C botulinum toxin. Avian cholera is another disease that has killed many birds at the Salton Sea but is not a human health threat. The organism that causes avian cholera (*Pasteurella multocida*) is totally different from the organism that causes human cholera (*Vibrio cholerae*).

Hazards addressed in other sections of this document that are not discussed in this section include earthquakes and other geologic hazards (Section 3.3, Geology and Soils), hazards to fish (Section 3.6, Fisheries and Aquatic Ecosystems), hazards to wildlife (Section 3.8, Vegetation and Wildlife), hazards to birds (Section 3.7, Avian Resources), and airborne hazards (Section 3.4, Air Quality).

3.14.3 Biological Pathogens

Biological pathogens exist in the Salton Sea, its tributaries, and the surrounding area. The primary pathogens of concern include fecal contaminants and Vibrio bacteria.

Fecal Contaminants

No human outbreaks of diseases attributable to fecal contaminants in the Sea have been recorded in either Imperial County or Riverside County (Ackison, D., April 12, 1999, personal communication; Cole, B., August 12, 1999, personal communication). However, due to public health concerns, the Imperial County Public Health Department collects monthly water samples along the shoreline of the Salton Sea to monitor concentrations of *Escherichia coli* bacteria, a common fecal contaminant (Johnston, M., April 7, 1999, personal communication). The samples collected at 11 shoreline locations in 1997 and 1998 had highly variable concentrations of *E. coli* that ranged from zero colonies per 100 milliliters (ml) to 624,000 colonies per 100 ml (Johnston, M., August 12, 1999, personal communication); information on the sampling and analysis protocols, data validation, and peer review of this data was not available.

Between 1980 and 1993, the CRB-RWQCB collected quarterly water samples from the middle of the Sea and tested them for fecal coliform. These samples had fecal coliform concentrations ranging from 2 to 20 colonies per 100 ml (CRB-RWQCB 1999); information on the sampling and analysis protocols, data validation, and peer review of this data was not available. The 1994 Water Quality Control Plan water quality objectives applicable to the Salton Sea include maximum allowable levels of 235 colonies per 100 ml for *E. coli* and 400 colonies per 100 ml for fecal coliform (CRB-RWQCB 1994).

The probable source of fecal contamination in the Sea is municipal wastewater discharged into the New River, Alamo River, and Whitewater River; however, waste excreted by birds at the Sea also may contribute to the concentration of these bacteria. Between 1980 and 1993, the CRB-RWQCB collected quarterly water samples from the mouths of the Alamo River and the Whitewater River and tested them for fecal coliform. The Alamo River samples had fecal coliform concentrations ranging from 170 to 240,000 colonies per 100 ml (CRB-RWQCB 1999); information on the sampling and analysis protocols, data validation, and peer review of this data was not available. The Whitewater River samples had fecal coliform concentrations ranging from 2.0 to 540 colonies per 100 ml (CRB-RWQCB 1999); information on the sampling and analysis protocols, data validation, and peer review of this data was not available. Water samples collected from the New River are discussed below.

Imperial County has posted warning signs along the New River advising people not to consume fish from the river and to avoid contact with the river water; this is primarily due to the high levels of fecal coliform bacteria in the river water (Johnston, M., August 12, 1999, personal communication). In 1977, samples of New River water were collected from 16 locations between the United States-Mexico border and the Salton Sea. The highest fecal coliform level was 2,800,000 colonies per 100 ml at Brockman Road (approximately 52 miles upstream from the Sea), and the lowest level was 1,000 colonies per 100 ml at Lack Road (approximately three and a half miles upstream from the Sea) (Setmire 1984). Between 1980 and 1993, the CRB-RWQCB collected quarterly water samples from the mouth of the New River and tested them for fecal coliform. These samples had fecal coliform concentrations ranging from 500 to 160,000 colonies per 100 ml (CRB-RWQCB 1999); information on the sampling and analysis protocols, data validation, and peer review of this data was not available. The probable source of fecal coliforms is municipal wastewater discharged into the New River; however, waste excreted by birds and discharges from livestock feedlots also may contribute to contamination levels. The CRB-RWQCB plans to develop a TMDL for bacteria in the New River by 2005.

At the Salton Sea, the primary exposure pathway of concern for fecal contaminants is ingestion. People that accidentally ingest Sea water could be exposed to fecal contaminants present in the water.

While not a health threat itself, the presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other animals. One of the fecal coliform bacteria that is commonly present in the fecal material of warm-blooded animals is E. coli; while there are certain strains of E. coli that are human pathogens, these strains have not been identified at the Salton Sea. Water containing fecal coliform bacteria also may contain other bacteria and viruses, some of which may be human pathogens. Viral and bacterial gastroenteritis and hepatitis are examples of diseases caused by waterborne pathogens. The presence of high levels of fecal coliforms is an indicator that a potential health risk exists for individuals exposed to this water. Because fecal coliform analysis typically is not done at a level of analysis that differentiates the species of origin for those coliforms, the assumption is made that high levels of coliforms are a threat for human health.

Vibrio Bacteria

No cases of Vibrio infections in the human population have been reported in either Imperial County or Riverside County (Ackison, D., April 12, 1999, personal communication; Cole, B., August 12, 1999, personal communication). However, the Imperial County Environmental Health Department has issued an advisory on fish consumption due to the presence of Vibrio bacteria in several fish species. The advisory provides information on identifying fish potentially infected by Vibrio bacteria and precautions directed at the public to protect the healthy fish they have caught from becoming infected through the handling of diseased fish (Johnston, M., August 12, 1999, personal communication).

The primary pathways for exposure to the Vibrio bacteria are ingestion and dermal contact. People who consume raw or improperly cooked fish could be exposed to Vibrio bacteria present in fish. People with open wounds or sores who handle fish or contact Sea water, including fishermen, swimmers and researchers, could also be exposed to Vibrio bacteria.

While two species of Vibrio, *Vibrio vulnificus* and *V. alginolyticus,* have been isolated from dead and dying fish at the Sea (US Fish and Wildlife Service/Salton Sea National Wildlife Refuge 1997-1998), the probable cause of large scale die-offs at the Sea is anoxia. *V. vulnificus* is a bacterium that naturally occurs in warm seawater and estuary water (Centers for Disease Control and Prevention 1999). It can cause disease in people who eat contaminated seafood or have open wounds that are exposed to seawater containing the bacterium. In healthy individuals, ingesting the bacterium can cause vomiting, diarrhea, and abdominal pain. In persons with compromised immune systems, particularly those with chronic liver disease, *V. vulnificus* can infect the bloodstream, causing a severe and life-threatening illness characterized by fevers and chills, decreased blood pressure, and blistering skin lesions (Centers for Disease Control and Prevention 1999). Persons with wounds infected by the bacterium experience symptoms that include fevers and chills, and the infected wound location is characterized by redness, swelling, pain, and tissue destruction (Oliver 1999). *V. alginolyticus* also occurs in warm salt water environments and can cause localized infections of open wounds that are exposed to seawater containing the bacterium (American Water Works Association Research Foundation 1997).

3.14.4 Mosquito-borne Diseases

The Coachella Valley Mosquito and Vector Control District in Riverside County has identified western equine encephalomyelitis and Saint Louis encephalitis as the two mosquito-borne diseases of greatest concern within the district. Both of these viruses can be transmitted from wild birds to humans by the encephalitis mosquito. However, no cases of mosquito-borne diseases in the human population have been reported in Imperial County or Riverside County (Johnston, M., April 7, 1999, personal communication; Ackison, D., April 12, 1999, personal communication; Cole, B., August 12, 1999, personal communication).

Exposure to these viruses occurs when a person is bitten by a mosquito that has fed on an animal infected with the virus. Residents and visitors to the Salton Sea form the population that could be exposed to these viruses.

The encephalitis mosquito (*Culex tarsalis*) primarily breeds in the brackish marshes present at the Salton Sea (Lothrop, B., December 17, 1999, personal communication). These marsh areas include zones where the freshwater tributaries mix with Sea water, locations where shallow groundwater and Sea water mix, and duck-hunting clubs that rely on freshwater input. This mosquito also breeds in areas where Sea water has collected and marsh vegetation is present. These areas, in addition to the water and wastewater canals within the basin, provide breeding habitat for mosquitoes. *C. tarsalis* is active from March to May and from September to November and can travel up to ten miles from its nesting area. It can be controlled by minimizing the amount of vegetation present in water or by applying an insect growth regulator to water.

Western Equine Encephalomyelitis

This disease has been detected in mosquitoes captured along the northern shoreline of the Salton Sea (Mosquito and Vector Control Association of California 1999). The western equine encephalomyelitis virus initially was isolated from sick horses in 1930 and from a fatal human case in 1938. This virus causes an acute fever-based illness in horses and humans, characterized in its most severe form by signs and symptoms of inflammation and injury of the meninges, brain, and spinal cord. Large outbreaks occurred in the north-central United States in 1941 and in the Central Valley of California in 1952, and both sporadic cases and small epidemics continue to occur throughout the western states.

The incubation period for the virus is usually five to ten days. The onset of the illness can be sudden, especially in adults, or characterized by a two- to four-day period of lethargy, fever, and headache, especially in children (Coachella Valley Mosquito and Vector Control District 1999a). The acute illness is characterized by a spectrum of symptoms and signs related to the central nervous system, reflecting infection and inflammation of the meninges and brain tissues. Fever, sleepiness, headache, anorexia, vomiting, and stiff neck are the most common features of an acute infection. The acute phase lasts three to ten days, after which recovery begins suddenly and proceeds rapidly. Generally, full recovery occurs, with rare instances of permanent neurological symptoms. However, about half of the affected infants suffer permanent secondary effects, including progressive retardation and major motor disorders.

Saint Louis Encephalitis

Humans infected with the Saint Louis encephalitis virus can develop encephalitis, which is an inflammation of the brain tissue. This disease is sometimes called "sleeping sickness" or "summer flu." The virus was first identified from victims of a 1933 epidemic in St. Louis, Missouri.

The encephalitis mosquito, *C. tarsalis*, is the primary vector of Saint Louis encephalitis virus in California (Coachella Valley Mosquito and Vector Control District 1999b). This mosquito becomes infected while feeding on birds infected with the virus. Once infected, a mosquito can transmit the virus to other birds, humans, or wildlife. The natural cycle of virus transmission in nature involves mosquitoes, birds, and other animals. Humans can be severely affected by the virus but are "dead end" hosts because not enough virus develops in their blood to infect other mosquitoes.

A Saint Louis encephalitis infection can be unnoticeable, acute, or fatal. Most Saint Louis encephalitis cases are unnoticeable infections that are mild or subclinical. Symptoms of infection appear seven to 21 days after a bite from an infected mosquito (Coachella Valley Mosquito and Vector Control District 1999b). Saint Louis encephalitis has three separate syndromes: feverish headache, noninfectious meningitis, and encephalitis. All age groups are susceptible to the disease, but children under nine are less likely to become ill than the elderly; thus, severity of the disease is age dependent.

3.14.5 Chemical Hazards

While many potential chemical contaminants are present within the water of the Salton Sea, as discussed in Section 3.1, Surface Water Resources, this section focuses on those chemical hazards that are potential public health threats of concern, due either to their concentrations or to their characteristics.

Selenium

The Office of Environmental Health Hazard Assessment has issued an advisory on consuming sport fish caught in the Salton Sea, based on elevated selenium levels in the fish (Office of Environmental Health Hazard Assessment 1999). The advisory recommends that no more than four ounces of croaker, orange-mouth corvina, sargo, and tilapia be eaten in any two-week period. In addition, pregnant women, nursing mothers, and children under 15 are advised to consume no fish caught in the Sea. No cases of selenium poisoning attributable to the Salton Sea have been reported in either Imperial County or Riverside County (Ackison, D., April 12, 1999, personal communication; Cole, B., August 12, 1999, personal communication).

At the Salton Sea, the primary exposure pathway is consumption of fish or waterfowl that contain selenium in their tissues. Thus, the population that could be exposed consists of people who consume fish and waterfowl from the Sea. In 1990, Setmire and others found that the concentration of selenium in water was lower in the Salton Sea than in the New and Alamo rivers and that the concentration of selenium in bottom sediments was higher in the Salton Sea than in the New and Alamo Rivers (Setmire et al. 1990). Selenium can accumulate in organisms as it passes up the food chain from bottom dwelling plants and animals that take in selenium from the sediment to higher food chain organisms such as fish and waterfowl. Fish and waterfowl samples were collected at the Salton Sea and tested for selenium concentrations in 1986 and 1987. Selenium levels in tilapia and corvina ranged from 3.5 micrograms per gram (g/g) to 20 g/g; the health advisory level is 8 g/g for human consumption of fish (Setmire et al. 1990). A composite sample of corvina, the Sea's most popular sportfish, collected near the Alamo River delta had a selenium concentration of 20.0 g/g in its edible muscle fillet.

The normal intake of selenium in food, about 50 to 150 micrograms per day, is enough to meet the daily need for this essential nutrient (Agency for Toxic Substances and Disease Registry 1989). At these levels, selenium acts as an antioxidant by preventing oxygen from damaging tissues. Selenium compounds can be harmful, however, at daily levels that are only somewhat higher than the beneficial level. If elevated amounts of selenium were consumed over long periods, several health effects could occur, including brittle hair, deformed nails, and, in extreme cases, loss of feeling and control in arms and legs (Agency for Toxic Substances and Disease Registry 1989). Information about the health effects of eating or drinking large doses of selenium over long periods has come from areas in China with very high selenium levels in the soil and in the rice and vegetables people eat. These people had loss of hair, loss of and poorly formed nails, problems with walking, reduced reflexes, and some paralysis. No populations in the United States have been reported with symptoms of serious, long-term selenium poisoning.

Although exposure to high levels of inorganic selenium compounds has been shown to cause birth defects in birds, selenium compounds have not been shown to cause birth defects in humans or in other mammals. People exposed to selenium dust and airborne selenium compounds in the workplace have reported dizziness, fatigue, irritation of mucous membranes, and, in extreme cases, fluid in the lungs (pulmonary edema) and severe bronchitis.

Contaminated Sites

Hazardous Material and Waste Sites

A search was conducted of the US Environmental Protection Agency's database (US Environmental Protection Agency 1997) incorporating data from the following programs: Aerometric Information Retrieval System, Facility Subsystem; Permit Compliance System; Toxic Release Inventory System; Comprehensive Environmental Response, Compensation, and Liability Information System; and, Resource Conservation and Recovery Information System. This search identified no listed sites within 500 feet of the current waterline of the Sea. The search was conducted because hazardous materials or wastes at sites within the Sea level fluctuation zone could be transported into the Sea by the rising and falling of the Sea. The only other potentially contaminated site is the Navy Salton Sea Test Base, which is discussed below.

Contaminated Sediments

LFR Levine-Fricke sampled sediments in the Salton Sea and its tributaries in December 1998 and January 1999 and published a report of its findings in July 1999 (LFR Levine-Fricke 1999b). The results of this and other sediment studies are discussed in greater detail in Section 3.3, Geology and Soils. The inorganic compounds of potential ecological concern identified in its report were cadmium, copper, molybdenum, nickel, selenium, and zinc. The organic compounds of potential ecological concern identified in its report were acetone, carbon disulfide, and 2-butanone. While the levels of these compounds detected in some sediment samples are of potential ecological concern, it is not known whether these levels present a hazard to human health through exposure pathways. None of these compounds are included in the fish advisory related to consumption of fish from the Salton Sea.

Salton Sea Test Base

The Salton Sea Test Base occupies 7,240 acres of land and 12,180 acres of water in the southwest portion of the Salton Sea ten miles south of Salton City. From 1939 to 1991, the based was used for a variety of military activities, including seaplane operations, torpedo tests, inert atomic bomb tests, ballistic drop and parachute tests, and live-fire training exercises. Activities conducted at the test base resulted in the contamination of various portions of the property. Some of the identified sources of contamination include underground storage tanks, landfills, workshops, small arms range, septic tank, and an explosive ordnance disposal area. The US Navy undertook a site investigation and remediation program to identify potential areas of contamination and to remediate those areas verified as contaminated. All remedial activities were completed by early 1998 (Radecki, M., April 12, 1999, personal communication).

In July 1999, an Ordnance and Explosives Investigation Report (US Army Engineering and Support Center 1999) reported the findings of surveys and sampling at the Salton Sea Test Base. Two former aerial bomb drop targets (used primarily for unarmed aerodynamic test drops) are located within the current footprint of the Salton Sea; due to technological limitations, none of the test base acreage within the Salton Sea was surveyed or sampled. A visual surface survey of all 7,240 land acres was conducted from July 1996 to March 1997. This survey recovered 99 unexploded ordnance (UXO) items from the ground surface; these UXO items included mortar rounds, grenades, missile motors, flares, and fuses. A subsequent subsurface sampling investigation of 300 grids (100 feet by 200 feet) located throughout the base was conducted from April to June 1997. This investigation recovered 16 UXO items from the top three feet of soil within the grids. Based on these investigations and risk analysis modeling, the US Navy selected risk management actions as its preferred program to protect the public from exposure to UXO (US Army Engineering and Support Center 1999). This program would not involve removal of UXO, but would undertake an educational effort to inform the public and the future property owner (US Department of the Interior) of the potential UXO hazards.

3.15 UTILITIES AND PUBLIC SERVICES

3.15.1 Introduction

The affected environment discussion for utilities and public services includes water service, wastewater service, electricity, solid waste disposal, traffic, public education, and police and fire service. For each utility and public service, an overview of the Phase I study area is presented, and detailed information is given for specific service providers that are anticipated to be affected by the Proposed Action or alternatives.

Imperial County. A variety of organizations play a role in providing utility and public services to the residents of Imperial County. Each of the seven incorporated cities in the county (Brawley, Calexico, Calipatria, El Centro, Holtville, Imperial, and Westmorland) provides facilities for water treatment, sewage treatment, and police and fire services. Other organizations providing services in Imperial County include school districts, special districts, and private utility companies (Imperial County 1997)

Riverside County. In the eastern portion of Riverside County, the county government provides many of the public services. The city of Coachella provides some of its own public services and contracts with Riverside County for others. Special districts, school districts, and private utility companies provide the remainder of public services and utilities in this portion of Riverside County.

3.15.2 Utilities

Utility systems addressed in this analysis include the facilities and infrastructure used for the following:

- Potable water pumping, treatment, storage, and distribution;
- Wastewater collection and treatment;
- Solid waste disposal; and
- Electrical generation and distribution.

Water Service

Imperial County. The IID distributes water to over 500,000 acres of farmland, as well as to ten communities in Imperial County for domestic purposes: Calexico, Holtville, El Centro, Imperial, Brawley, Westmorland, Calipatria, Niland, Seeley, and Heber. Each of these cities and unincorporated communities has its own water treatment facilities for treating and distributing water within its jurisdiction. Ocotillo is provided water service by private water companies and individual wells, Palo Verde by the Palo Verde County Water District, and Hot Mineral Spa/Bombay Beach by the Coachella Valley Water District (Imperial County 1997).

Imperial Irrigation District. The IID is a community-owned utility that provides water for irrigation, domestic use, and electric power to the Imperial Valley. All of the water received by the IID (approximately three million acre-feet per year) is diverted from the Colorado River. The Imperial Dam diverts Colorado River water to southern

California, Arizona, and Mexico. Colorado River water diverted at the Imperial Dam for use in the Imperial Valley first passes through one of three desilting basins, each of which removes 70,000 tons of silt per day. From the desilting basins, the water is conveyed to the Imperial Valley via the All American Canal.

Three main canals, the East Highline, Central Main, and Westside Main, are used to convey water from the All American Canal to the many lateral canals that exist throughout the Imperial Valley. Farmers divert water directly from these laterals for irrigation. Seven regulating reservoirs and three interceptor reservoirs with a total storage capacity of more than 3,400 acre-feet are an important component of the IID's distribution system.

The total volume of water delivered by the IID for the past five years is shown in Table 3.15-1. Of the water IID transports, 98 percent is used for agriculture; the remaining two percent is used for industrial purposes or is delivered to cities, which treat it to safe drinking water standards and sell it to their residents (Imperial Irrigation District 1998).

Table 3.15-1
Historic Water Volumes (in acre-feet) Delivered by the IID

Category	1993	1994	1995	1996	1997
Agricultural	2,414,113	2,674,282	2,678,768	2,821,987	2,803,640
Industrial	14,897	17,152	17,708	18,130	17,458
Municipal	30,513	31,439	34,052	34,267	31,374
Total	**2,459,523**	**2,722,873**	**2,730,528**	**2,874,384**	**2,852,472**

Source: Imperial Irrigation District 1998

The IID currently uses structural and nonstructural water conservation measures, including canal concrete lining, nonleak gates, system automation, lateral interceptors, and on-farm irrigation water management. The IID and the MWD of southern California have a water conservation and transfer agreement, in which the MWD has financed the cost of construction, operation, and maintenance of certain water conservation projects in exchange for diverting additional water from the Colorado River to its service area.

Riverside County. Water service in the vicinity of the Salton Sea in Riverside County is provided by the CVWD, which provides irrigation and domestic water to areas within its 640,000 acre jurisdiction. The CVWD obtains its water from the Colorado River, State Water Project, and ground water. Colorado River water is obtained from the Coachella Canal, which branches from the All American Canal. Urban water is obtained from up to 80 wells in operation at any one time. CVWD supplements this supply with State Water Project and Colorado River water. Historic water volumes delivered by the CVWD are shown in Table 3.15-2.

Table 3.15-2
Historic Water Volumes (in acre-feet) Delivered by the CVWD

Category	1994-1995	1995-1996	1996-1997	1997-1998
Irrigation	283,187	TBS	286,548	266,125
Domestic	79,920	TBS	92,102	89,446
Total	**363,107**	**TBS**	**378,650**	**355,571**

Source: Coachella Valley Water District 1995, 1998

Wastewater Service

Each of the cities and incorporated communities of Heber, Niland, Seeley, and Winterhaven provide sewage treatment. The California RWQCB issues permits under the National Pollutant Discharge Elimination System (NPDES) program for these sewage treatment plants, which generally provide primary and secondary sewage treatment. Rural residences on existing lots and minor subdivisions use septic tanks and leach line systems, which require a minimum lot size of 20,000 square feet (approximately half an acre) per dwelling for approval by the Imperial County Health Department. Bombay Beach has a public sewage system operated by the CVWD, while Hot Mineral Spa relies on subsurface septic systems or facilities operated by mobile home or RV parks. Ocotillo and Palo Verde have no sewage treatment facilities and rely on subsurface septic systems (Imperial County 1997).

Electrical Service

The IID provides and distributes electricity to approximately 90,000 customers in Imperial County and parts of Riverside and San Diego counties. Because of the extremely hot summers in the region, per capita power consumption in the Imperial Valley is approximately 30 percent higher than the national average (Imperial Irrigation District 1998).

The IID operates nine hydroelectric generation plants, a 180-megawatt (MW) steam plant, eight gas turbines, and an eight-unit diesel plant. In addition, the IID obtains power from outside sources. With the Southern California Public Power Authority, the IID has an ownership interest of 14.6 MW of the Palo Verde Nuclear Generation Station in Arizona. IID is a one-third participant with Southern California Edison and Arizona Public Service Company in a 75-MW steam plant. Also, the utility purchased an interest in the Palo Verde-San Diego 500-kv transmission line, which allows the IID to have access to cheaper imported energy. The IID has an energy supply contract with El Paso Electric Company for 100 MW of electricity, which will increase to 150 MW by 2002. Table 3.15-3 provides information regarding the amount of energy sold by the IID for the past five years.

Table 3.15-3
Historic Electric Power Volumes Delivered by the IID

Category	1993	1994	1995	1996	1997
Residential	830,757	884,516	867,229	942,020	952,866

Commercial/Industrial	1,160,942	1,231,184	1,276,291	1,272,742	1,297,306
Other	144,261	154,823	157,593	167,684	162,161
Total	**2,135,960**	**2,270,523**	**2,301,113**	**2,382,446**	**2,412,333**

Source: Imperial Irrigation District 1998

Geothermal exploration is being conducted in nine KGRAs in Imperial County. There are currently 15 geothermal plants in Imperial County, seven of which are in the Salton Sea KGRA, which generally encompasses the southeastern portion of the Sea and the land area to the east, approximately to the communities of Niland and Calipatria.

3.15.3 Solid Waste Disposal Facilities

Table 3.15-4 summarizes information on permitted landfills in Imperial and Riverside counties in the vicinity of the Salton Sea.

Imperial County. All cities in Imperial County regulate waste storage and disposal and provide for waste collection services within their jurisdictions, using either a city-operated system or a contract with a private firm. Waste collection services are available in some unincorporated areas through contract with private firms.

There are 10 county-operated Class III disposal sites in Imperial County that accept nonhazardous wastes. Three of the county landfills are on land owned by the county (near Brawley, Imperial, and Calexico), six are on BLM property (Holtville, Niland, Salton City, Hot Mineral Spa, Ocotillo, and Palo Verde), and one is on the Quechan Indian Reservation (Picacho landfill, serving the Winterhaven area).

In addition to the public sites, Imperial Republic Acquisitions operates a private Class III waste disposal facility southeast of the Salton Sea, Laidlaw Environmental Services operates a Class I facility west of Westmorland, and the Desert Valley Company operates a Class II solid waste disposal and storage site northwest of Westmorland (Imperial County 1997).

Riverside County. There are two permitted Class III landfills in the vicinity of the Salton Sea: Mecca Landfill II and Oasis Sanitary Landfill (California Integrated Waste Management Board 1999).

3.15.4 Other Public Services

The other key public service examined for this analysis is traffic. Providers for this service are federal, state, regional, and local transportation agencies.

Table 3.15-4
Summary of Solid Waste Facilities

County/ Facility Name	Facility Location	Permitted Site Capacity (cubic yards)	Waste Types
Imperial County			
Brawley Disposal Site	Hovely Road and the New	2,044,000	Construction/demolition, mixed

	River		municipal, other designated
Calexico Disposal Site	New River and Highway 98	850,000	Agricultural, construction/demolition, mixed municipal, other designated
Desert Valley Company	3301 West Highway 86, Westmorland	514,000	Industrial
Holtville Disposal Site	8 miles northeast of Holtville	518,500	Construction/demolition, mixed municipal, other designated
Hot Spa Cut and Fill Site	Bombay Beach	70,000	Construction/demolition, mixed municipal
Imperial Waste Site	Worthington and New River	1,936,000	Construction/demolition, mixed municipal
Mesquite Regional Landfill	5 miles northeast of Glamis	970,000,000	Construction/demolition, mixed municipal
Niland Cut and Fill Site	4 miles northeast of Niland	131,000	Construction/demolition, mixed municipal
Ocotillo Cut and Fill Site	3 miles northwest of Ocotillo	516,267	Construction/demolition, mixed municipal
Palo Verde Cut and Fill Site	3 miles west of Palo Verde	516,000	Construction/demolition, mixed municipal
Picacho Cut and Fill Site	Picacho Road between Winterhaven and Picacho Park	645,333	Construction/demolition, mixed municipal, other designated, tires
Republic Imperial Landfill	Imperial	4,324,200	Agricultural, ash, construction/demolition, industrial, mixed municipal, tires
Salton City Cut and Fill Site	7 miles west of SR-86, south of Salton City	2,581,300	Construction/demolition, mixed municipal
Riverside County			
Mecca Landfill II	Mecca	587,694	Agricultural, construction/demolition, mixed municipal
Oasis Sanitary Landfill	Oasis	8,700,000	Agricultural, construction/demolition, contaminated soil, mixed municipal

Source: California Integrated Waste Management Board 1999

Traffic. Transportation planning for regional highways serving the Salton Sea area is conducted by Caltrans, regional agencies, such as the Southern California Association of Governments (SCAG), Imperial County and Riverside County, and the federal government. As required by the Alquist-Ingalls Act (Assembly Bill 402), Caltrans prepares the State Transportation Improvement Program (STIP) that SCAG uses to develop a Regional Transportation Improvement Program (RTIP). The federal government identifies federally funded projects from the STIP and RTIP that will be included in the Federal Transportation Improvement Program. Riverside County and Imperial County provide transportation planning for roads other than regional highways in the circulation elements of their respective general plans.

Current roadway operating conditions for roadway segments have been identified by Caltrans, SCAG, and Riverside and Imperial counties. These operating conditions are generally expressed in terms of level of service (LOS) developed by comparing roadway capacity to traffic volumes. Table 3.15-5 provides LOS designations and a description of operating conditions that determine LOS. The SCAG Congestion Management Plan (CMP) and the circulation elements of the Riverside County and Imperial County general plans identify the minimum acceptable LOS for road segments in Riverside and Imperial counties.

Table 3.15-5
Road Transportation Level of Service Criteria

Level of Service	Description
A	Free flow with users unaffected by the presence of other users on the roadway.
B	Stable flow, but presence of other users in traffic stream becomes noticeable.
C	Stable flow, but operation of users becomes affected by others in the traffic stream.
D	High-density but stable flow, speed and freedom of movement are severely restricted, poor level of comfort and convenience.
E	High-density with traffic demand usually at capacity, resulting in very long traffic delays.
F	Forced or breakdown flow with traffic demand exceeding capacity, unstable stop-and-go traffic.

State Route (SR) 78, SR-86, and SR-111 provide regional access to the Salton Sea. These roads are described in the following paragraphs.

SR-78 is an east-west route that begins at Interstate (I)-10 at Blythe in Riverside County and continues south of the Salton Sea through Palo Verde, Brawley, and Westmorland before terminating at I-5 in San Diego County. SR-78 is a two-lane highway (one travel lane in each direction). Daily traffic volumes on SR-78 are shown on Table 3.15-6. Outside Brawley, SR-78 carries low traffic volumes. Caltrans is planning improvements to SR-78 in Brawley, at the SR-111 interchange, to relieve congestion. A four-lane expressway bypass is planned from

Table 3.15-6
Traffic Volumes on Key Roads

Road Segment/Location	Number of Lanes	LOS	Peak-hour Traffic[1]	AADT[2]
State Route 78 Segments				
Imperial County Border to Junction of SR-86	2	A	70	630
Junction of SR-86 to Brawley, Third Street	2	D	1,500	18,000
Brawley, Third Street to Brawley, Sixth Street	2	D	1,500	18,000
Brawley, Sixth Street to West Junction SR-111	2	D	1,350	16,500
West Junction SR-111 to Brawley, Tenth Street	2	D	1,550	18,600
Brawley, Tenth Street to Brawley, Eastern Avenue	2	C	910	10,900
Brawley, Eastern Avenue to East Junction SR-111	2	B	680	8,200
East Junction SR-111 to West Junction SR-115	2	A	320	3,450
West Junction SR-115 to East Junction SR-115	2	A	320	3,150
East Junction SR-115 to Glamis	2	A	320	2,200
Glamis to Ogilby Road	2	A	180	1,200
Ogilby Road to Palo Verde, Fourth/Main Street	2	A	280	1,900
Palo Verde, Fourth/Main Street to Riverside County Boundary	2	A	220	2,300
State Route 86 Segments				
South Junction of SR-78 to Brawley, Rio Vista Avenue	4	A	1,250	14,000
Brawley, Rio Vista Avenue to Brawley, Las Flores Drive	4	A	860	9,800
Brawley, Las Flores Drive to Cady Road	4	A	580	6,600
Cady Road to Westmoreland, B Street	4	A	420	4,800
Westmorland, B Street to Westmorland, Center St.	4	A	380	4,350
Westmorland, Center Street to Westmorland, H Street	4	A	770	8,800
Westmorland, H Street to Lack Road	4	A	600	6,900
Lack Road to SR-78	4	A	650	8,500
SR-78 to Air Park Drive	4	A	590	7,600
Air Park Drive to Salton City, South Marina Drive	4	A	600	7,700
Salton City, South Marina Drive to Salton Sea Beach Road (Brawley Road)	4	A	700	9,000

Table 3.15-6
Traffic Volumes on Key Roads *(continued)*

Road Segment/Location	Number of Lanes	LOS	Peak-hour Traffic[1]	AADT[2]
Salton Sea Beach Road (Brawley Road) to Desert Shores Drive	4	A	610	7,600
Desert Shores Drive to Riverside County boundary	4	A	800	9,900
Riverside County boundary to 80th Avenue	4	A	800	11,200
80th Avenue to SR-195	4	A	820	10,300
SR-195 to Polk Street/ 70th Avenue	4	A	730	9,300
State Route 111 Segments				
Brawley, West Junction SR-78 to Brawley, E Street	2	C	780	9,500
Brawley, E Street to Brawley, B Street	2	C	750	9,200
Brawley, B Street to Brawley, A Street	2	D	940	11,500
Brawley, A Street to Brawley, Adler Street	2	C	600	7,300
Brawley, Adler Street to Shank Road	2	C	520	5,500
Shank Road to Rutherford Road	2	C	590	6,200
Rutherford Road to Calipatria South City Limit	2	C	690	7,300
Calipatria South City Limit to SR-115	2	C	690	7,300
SR-115 to Calipatria, California Street	2	C	710	7,500
Calipatria, California Street to Sinclair Road	2	C	600	6,300
Sinclair Road to Niland, Niland Avenue	2	C	570	6,000
Niland, Niland Avenue to Niland, Third Street	2	C	550	5,800
Niland, Third Street to Beal Road	2	C	600	6,300
Beal Road to English Road	2	C	480	5,100
English Road to Bombay Beach Road	2	B	260	2,700
Bombay Beach Road to Riverside County boundary	2	B	270	3,300
Riverside County boundary to Salton Sea State Park Road	2	B	270	3,300
Salton Sea State Park Road to SR-195	2	B	370	3,800
SR-195 to Thermal, Church Street	2	C	620	6,300
Thermal, Church Street to Airport Boulevard	2	D	830	8,500
Airport Boulevard to Coachella, Avenue 52	2	D	880	9,000

Source: Caltrans 1998

Notes: [1] Peak-hour traffic in both directions.
affic (AADT) is the total volume for the year divided by 365 days.

1.5 miles south of the eastern junction of SR-78 and SR-111 to SR-86, north of Brawley. This project is anticipated to be completed by the end of 2004 (Caltrans 1999).

SR–86 is the main north-south access between I-8 and I-10 in Imperial and Riverside counties and is one of the principal farm-to-market routes to the Los Angeles distribution points. SR-86 begins at I-10 in Indio, parallels the western side of the Salton Sea, joins with SR-78 south of Salton City, continues through Westmorland to Brawley, then splits from SR-78 and continues south through Imperial, El Centro, and Heber and terminates at SR-111. Daily traffic volumes on SR-86 are shown on Table 3.15-6. There is a high percentage of large trucks using SR-86, up to 48 percent at times, and heavy recreational traffic on the fall, winter, and spring weekends. SR-86 is being upgraded from a two-lane freeway to a four-lane expressway, with shoulders for emergency parking and with access on and off the road at designated major cross streets in Imperial and Riverside counties. The 20-mile section of SR-86 in Riverside County between Avenue 82 near Oasis and Interstate 10 in Indio will be constructed on a new alignment. The upgrade is estimated to be completed by the summer of 1999 (Caltrans 1999).

SR-111 is a north-south route beginning at I-10 in Indio in Riverside County. The two-lane undivided roadway continues along the eastern side of the Salton Sea through Calipatria and Brawley. At I-8, the road widens to two travel lanes in each direction and ends at the international border at Calexico. Daily traffic volumes on SR-111 are shown on Table 3.15-6. Traffic congestion often occurs on SR-111 because of the high percentage of truck traffic, slow-moving farm equipment, recreational vehicles, and the lack of passing lanes. Caltrans is planning to upgrade SR-111 to a four-lane expressway from Ross Road (just north of I-8) to SR-78. The project will be completed in 2002.

3.16 CULTURAL RESOURCES

3.16.1 Introduction

The term cultural resources is widely used to include a broad range of resources, including archaeological, architectural, and ethnographic resources. All of these types of resources, as defined below, are discussed in the following section. A summary of the cultural background of the Salton Sea region is provided in Appendix D. A more detailed presentation of this information is provided within the *Salton Sea Cultural Resources Class 1 Survey Report* (Smith et al. 1999a).

Archaeological and Architectural Resources. Archaeological resources are generally divided into precontact (prehistoric) and post-contact (historic) resources. Precontact resources are physical properties resulting from human activities that predate the time of European contact in America. Precontact resources reflect aboriginal use of the land and can include village sites, temporary campsites, lithic scatters, fishing sites, roasting pits/hearths, milling features, petroglyphs/pictographs, rock features, and burials. Post-contact resources consist of physical properties, structures, or built items resulting from the activities of colonial Europeans or Americans. These resources are more than

50 years old but date after the time of contact between Native Americans and Europeans. Post-contact resources include both archaeological remains and architectural structures. Archaeological site types include townsites, homesteads, agricultural or ranching features, mining-related features, and refuse concentrations. Architectural resources can include houses, barns, stores, post offices, bridges, and community structures, such as churches, schools, and meeting halls.

Ethnographic Resources. Ethnographic resources are sites, areas, and materials important to Native Americans for religious, spiritual, or traditional reasons. Fundamental to many Native American religions is the belief in the sacred character of physical places, such as mountain peaks, springs, or burial sites. Traditional rituals often prescribe use of particular native plants, animals, or minerals, gathered from specific sources. Therefore, ethnographic resources can include a wide range of resources, such as villages, burials, petroglyphs, rock features, mountain peaks, springs, and traditional gathering areas. Such resources can be formally designated as traditional cultural properties (TCPs)or sacred sites. To be eligible for consideration as a TCP, a resource must meet criteria as presented in National Register Bulletin 38 *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990). A site must meet the definition set forth in Executive Order 13007 to be considered a sacred site by Federal law. Activities that may affect these resources, their accessibility, or availability of materials used in traditional practices are of primary concern in impact analyses. Although some types of ethnographic resources overlap with precontact and post-contact archaeological resources, they require separate recognition as unique cultural resources.

3.16.2 Identification Methods

Archaeological and Architectural Resources. Identification of cultural resources likely to be affected by the restoration of the Salton Sea focused on a buffer zone measuring five miles around the Sea (from the shoreline). Additional areas outside this five-mile radius where restoration actions may occur also were examined. To identify previous investigations that have been conducted and cultural resources that have been recorded within the five-mile radius and specific areas of potential effect (APEs), a record search was conducted through the California Historical Resources Information System (CHRIS). Information on surveys and sites in Riverside County were obtained from the CHRIS Eastern Information Center at the University of California, Riverside. Information on surveys and sites in Imperial County was gathered from the CHRIS Southeast Information Center at the Imperial Valley College Desert Museum in Ocotillo, California. Information on surveys and sites in San Diego County was gathered from the CHRIS South Coastal Information Center at San Diego State University.

Ethnographic Resources. Reclamation sent letters to 29 tribal organizations in California and Arizona to initiate consultation with regard to ethnographic resources important to the tribes that might be affected by the project. As required by CEQA, the Native American Heritage Commission (NAHC) was contacted for a list of tribes with traditional and historical ties to the area. This list was expanded to include 29 groups in accordance with Reclamation's policy to consult broadly. The expanded list was then approved by the BIA Sacramento Area Office and the NAHC. A more complete description of this methodology is presented in the report titled *Salton Sea Restoration Project: Contacts with Native American Groups* (Smith et al. 1999b).

After the initial consultation letters were sent, follow-up phone calls were made by Reclamation's ethnographic contractor to insure that each tribe had an opportunity to directly express their concerns. Questionnaires were faxed to groups that were difficult to contact by phone, as an alternative means for them to express their concerns. Tribal concerns regarding ethnographic resources were documented by the ethnographer for consideration in impact analyses. If follow-up phone calls were thought by a tribe to be insufficient as a means of documenting the tribe's concerns, meetings were scheduled with the tribe to further discuss their concerns regarding impacts to ethnographic resources. Tribes were encouraged to formally document their concerns by submitting written comments to Reclamation. The results of these efforts are summarized in 3.16.3 of this document. Responses are documented in detail in the summary report titled *Salton Sea Restoration Project: Contacts with Native American Groups* (Smith et al. 1999b).

In addition to individual tribal groups and organizations, the Kumeyaay Cultural Repatriation Committee (KCRC) was also contacted during data gathering efforts at the urging of several of the Kumeyaay groups initially contacted. KCRC represents twelve Ipai-Tipai bands of the Kumeyaay Nation: Barona, Campo, Ewiiaapaayp (Cuyapaipe), Inaja, Jamul, LaPosta, Manzanita, Mesa Grande, San Pasqual, Santa Ysabel, Sycuan, and Viejas. Nine of these groups had been formally contacted already by Reclamation and Reclamation's contracted ethnographers.

3.16.3 Known Resources

Archaeological and Architectural Resources. Information on known archaeological and architectural resources is provided here first for the five-mile buffer zone around the Salton Sea, and then specifically for each action.

<u>*Five-Mile Buffer Zone*</u>. Approximately 899 square miles (575,740 acres) are encompassed by the five-mile buffer zone around the Salton Sea. This figure includes 364 square miles (233,150 acres) that are inundated by the Sea, which are likely to contain submerged archaeological sites, as well as the surrounding 535 square miles (342,590 acres) of dry land. Roughly 47 square miles (30,000 acres) have been surveyed for cultural resources. Surveyed areas represent 5.2 percent of the total area within the buffer zone (including inundated portions), and 8.8 percent of the dry land contained within the buffer zone. Most recorded archaeological sites are concentrated in Imperial County near the southwestern shoreline of the Sea and in a line paralleling the southwestern and western shorelines. The eastern shoreline in Imperial County has a similar linear site distribution, although it appears less dense than that on the western side of the Sea. Rather than accurately reflecting the distribution of precontact and post-contact human activity, however, these patterns seem to represent cultural resource surveys conducted for recent projects, such as improvements to state highways 86 and 111 and the Coachella Canal, and the realignment and closure of the

U.S. Navy's Salton Sea Test Base. Further cultural resource surveys throughout the five-mile buffer zone would yield a larger, more representative data set from which more accurate site density and distribution patterns would emerge.

Within the five-mile buffer zone, 900 archaeological resources have been recorded. These include 802 precontact, 8 contact-era, 58 post-contact, and 22 multi-component resources, as well as 10 sites of unknown age. Table 3.16-1 shows the distribution of these sites by county.

Table 3.16-1
Archaeological Resources by County within the Five-Mile Buffer Zone Surrounding the Salton Sea

Sites	Precontact	Contact-Era	Post-Contact	Multi-Component	Unknown	Total	
Imperial	735	---	49	21	6	811	90.1%*
Riverside	62	7	9	1	4	83	9.2%*
San Diego	5	1	---	---	---	6	0.7%*
Total	**802**	**8**	**58**	**22**	**10**	**900**	**100 %***

*Percentage of total archaeological resources (n=900) recorded within the five-mile buffer zone.

Of the 802 precontact sites recorded within the five-mile buffer zone around the Salton Sea, 519 (64.7%) are activity loci and 283 (35.3%) are habitation sites (Table 3.16-2). Activity loci include nonhabitation sites, such as lithic and pottery sherd scatters, fish traps, milling sites, rock art, ceremonial sites, trails, storage features, and rock features. Habitation sites include temporary camps, limited habitation sites, and large habitation sites. Temporary camps include evidence of a person or group of people having camped for a short time while on a resource gathering or hunting expedition, or while traveling. These sites often contain a hearth(s) and/or sleeping area(s) with artifacts indicative of resource procurement. Limited habitation sites are similar to temporary camps, but exhibit evidence of longer-term or repeated use. Artifact/feature assemblages for limited habitation sites resemble those of temporary camps although they are indicative of a more varied and/or intense use of the site. Large habitation sites often occupy a large area, and are characterized by a high concentration and variety of artifacts, living structures, other features, and middens. Of the 283 precontact habitation sites within the five-mile buffer zone, 192 (67.9%) are temporary camps, 87 (30.7%) are limited habitation sites, and 4 (1.4%) are large habitation sites (Table 3.16-2).

Table 3.16-2
Precontact and Multi-component Site Types Recorded within the 5-Mile Buffer Zone Surrounding the Salton Sea

	Precontact and Multi-Component Sites (826)			
Site Type	**Precontact**	**Multi-Component***	**Total**	
Activity Loci	519	11	530	64.3%

Temporary Camps	192	5	197	23.9%
Limited Habitation Sites	87	5	92	11.2%
Large Habitation Sites	4	1	5	0.6%
Total	**802**	**22**	**824**	**100 %**

*The Predominant Component of all of the Multi-Component Sites is Precontact.

Eighty-seven precontact sites, most of which are within the boundaries of the Salton Sea Test Base, have been recommended eligible for listing on the National Register of Historic Places (NRHP). An additional three precontact sites within the five-mile buffer zone have been determined to be potentially NRHP-eligible.

All of the eight recorded contact-era sites within the five-mile buffer zone are habitation sites. Six (75%) are limited habitation sites, and two (25%) are large habitation sites, probably associated with the village of Cabazones.

Of the 58 recorded post-contact archaeological resources recorded within the five-mile buffer zone, 3 (5.2%) consist of structural or residence remains, 3 5.2%) are post-contact camp sites, and 52 (89.7%) are activity loci, such as refuse concentrations, road or trail segments, and railroad, agricultural, or mining sites. Two post-contact sites (2.7%) are of unidentified function (Table 3.16-3).

Twenty-two multi-component sites have been recorded within the five-mile buffer zone. The predominant components of 11 (50%) are precontact habitation sites of various sizes. The predominant components of the remaining 11 multi-component sites (50%) are activity loci (Table 3.16-2). Of the 11 precontact habitation sites represented within the multi-component sites, five (22.7%) are temporary camps, five (22.7%) are limited habitation sites, and one (4.54%) is a large habitation sites. The post-contact components of the 22 multi-component sites are predominantly activity loci. Seven multi-component sites, all of which are on the Salton Sea Test Base, have been recommended eligible for listing on the NRHP.

Nineteen post-contact architectural and engineering resources are located within the five-mile buffer area around the Salton Sea. One of these resources, the NRHP-listed Martinez Historical District, includes three early 20th century Indian Agency

Table 3.16-3
Post-Contact Sites Recorded within the Five-Mile Buffer Zone Surrounding the Salton Sea

	Post-contact Sites (74)	
Site Type	**Number of Sites**	**Percentage**
Structural Remains	1	1.7%

Residence	2	3.4%
Camp Sites	3	5.2%
Refuse Concentrations	13	22.5%
Wagon Road or Trail Segments	26	45.0%
Road Maintenance Station	1	1.7%
Wagon Remains	1	1.7%
Railroad-Related Sites	2	3.4%
Mining-Related Sites	3	5.2%
Agriculture-Related Sites	1	1.7%
Roadside Business Sites	2	3.4%
Human Burial Site	1	1.7%
Unknown Function	2	3.4%
Total	**58**	**100 %**

buildings on the Torrez-Martinez Reservation. The 18 remaining resources include 8 houses, 2 ranches, 2 schools, 1 barn, 1 bank, 1 café, 1 canal, 1 water tank, and the post-contact era structural remains of the U.S. Navy Salton Sea Test Base. Of these, 11 have been determined to be not eligible for listing on the NRHP, 1 is considered potentially eligible, and 6 have not been evaluated for NRHP eligibility. All of these resources are discussed in more detail in the *Salton Sea Cultural Resoruces Class 1 Survey Report* (Smith et al. 1999a).

Of the 10 sites of unknown age recorded within the five-mile buffer zone, four (40%) are activity loci, two (20%) are habitation sites, and four (40%) are not described on the archaeological site records on file. The two habitation sites are the remains of rock dwellings. Of the four activity loci, two consist of the remains of unidentifed rock arrangements, and two are trail sites. Assuming the 30,000 acres surveyed for cultural resources are representative of the entire five-mile buffer zone, including land inundated by the Sea, a site density of one site per 36.4 acres, or 18 sites per square mile, can be extrapolated. However, site density is likely to vary from area to area, depending on topography and past availability of natural resources. Site density within the Salton Sea Test Base, primarily reflecting precontact use of the shoreline environment of Ancient Lake Cahuilla, averages only one site per 45.7 acres, or 14 sites per square mile. Site density in the proposed NRHP Southwest Lake Cahuilla Recessional Shoreline Archaeological District within the Test Base is one site per 24.5 acres, or 26 sites per square mile. This is greater than the site density in the surveyed portions of the five-mile buffer zone and in the Test Base as a whole. The low sandstone ridge that is the predominant topographic feature of the district, as well as the focus of the highest concentration of sites, was once a narrow peninsula that extended several hundred meters into Ancient Lake Cahuilla, enclosing a small embayment. Its apparent importance as a habitation and activity area is probably related to its advantageous position next to thriving fish habitats (Apple et al. 1997). This association suggests that site density throughout the Salton Sea area may be higher in relation to certain types of shoreline features.

In addition to precontact, contact-era, and post-contact resources indicated on historical maps, at least 24 World War II-era U.S. Navy aircraft are reported to have crahsed or made forced landings in and near the Salton Sea. Of the crews of these aircraft, at least 18 men were killed and some of the submerged wreckage may still contain the remains of lost crewmen. The exact locations of the majority of the downed military aircraft are unknown; however, an Avenger torpedo-bomber that crashed in December 1947 was discovered by divers searching for a recently lost private plane. The U.S. Navy restricts diving to these aircraft sites and does not allow photography of human remains, or the disclosure of aircraft serial numbers. These aircraft may also be considered historical archaeological sites, subject to protection or treatment as cultural resources, and may also be subject to U.S. Navy jurisdiction. (Perry 1999; *Los Angeles Times* 1999).

Also, 25 localities consisting of historically documented stands of plants, water sources, or geological formations have been recorded within the five-mile buffer zone. These localities were originally noted by H. S. Washburn of the U.S. General Land Office during a survey of the Salton Sink in 1856. Twenty-one of the localities (84%) are springs, ponds, streams, or locations where water is near the ground surface. Of these 21 localities, 17 (81%) are freshwater, and four (19%) are salt water. Two of the 25 localities (8%) consist of mud cones. One locality (4%) is a mesquite grove, and one (4%) is an extensive salt deposit. Twelve of the 25 localities (48%) are in the vicinity of the southwestern shore of the Salton Sea, 11 (44%) are in the vicinity of the northeastern shore, and two (8%) are near the northwestern shore. No cultural resources have been recorded in association with these features; however, it is likely that they were of some importance to occupants of the area, and the potential exists for precontact or post-contact archaeological materials to be found nearby.

Areas that Would be Affected by the Northwest and Southwest Evaporation Ponds. Two precontact archaeological sites have been recorded within the APE of the Northwest and Southwest Evaporation Ponds. One of the sites is an activity locus, and the other is a temporary camp. These sites have been determined to be eligible for listing on the NRHP. Both sites are within the Northwest Pond area. The Northwest Pond covers approximately 9,894 acres, of which 1.2 percent, or 120 acres, have been surveyed for cultural resources. Of the 16,834 acres that make up the South Pond area, 0.15 percent, or 25 acres have been surveyed. About 98.5 percent of the Northwest and Southwest Evaporation Ponds APE is submerged beneath the Salton Sea. There is a potential for additional archaeological sites to exist, not only in the unsurveyed dry land portions of the APE but in the submerged portions, particularly in the eastern part of the Southwest Pond APE, which is within 4.5 miles of Obsidian Butte, an important precontact lithic source.

In addition to the affected areas in the Northwest and Southwest Evaporation Ponds APE, riprap and embankment material for the evaporation pond dikes will come from borrow areas in three sections west of the western shoreline of the Sea. Archaeological sites have been recorded within these three sections, and it is possible that additional sites will be found. Because riprap sources are in areas of exposed smooth bedrock surfaces, it is also possible that petroglyphs will be encountered.

Riprap will be taken from Section 20, Township 9 South, Range 9 East. None of this section has been surveyed for cultural resources; however, five recorded precontact archaeological sites exist there. Four are habitation sites, and one site is an activity locus. The four habitation sites consist of two temporary camps and two limited habitation sites. The NRHP eligibility of these sites has not been determined. The potential exists for additional archaeological sites to be encountered within the affected area of this section.

Embankment material will come from Sections 28 and 34, Township 9 South, Range 9 East. These sections have not been surveyed for cultural resources; however, 24 precontact archaeological sites have been recorded in Section 28, and one post-contact and 12 precontact sites have been recorded in Section 34. Of the 24 known precontact sites in Section 28, 10 are habitation sites and 14 are activity loci. Five of the habitation sites are temporary camps, three are limited habitation sites, and two are rock-lined house rings. One of the precontact activity locus sites in Section 28 has been determined to be eligible for listing on the NRHP. The eligibility of the remaining sites in Section 28 has not been determined. In Section 34, the known post-contact site is a segment of a wagon road. The 12 known precontact sites in Section 34 consist of one temporary camp and 11 activity loci. The NRHP eligibility of the sites in Section 34 has not been determined. The potential exists for additional archaeological sites to be encountered within the affected areas of these two sections.

Borrow material would be trucked into the construction site by way of a 60-foot-wide temporary haul road. Once construction of the dikes is completed, the road would be restored to pre-construction condition; however, previously unrecorded archaeological sites, which cannot be restored, may be encountered in the path of this road.

<u>Area that Would be Affected by the Pupfish Pond</u>. Approximately 60 acres (4%) of the 1,477-acre APE of the Pupfish Pond have been surveyed for cultural resources. No cultural resources have been recorded. However, the potential exists for archaeological sites to be encountered in both the shoreline and inundated portions of the APE.

To create the pond, additional dikes would be constructed from the north and south ends of the Southwest Evaporation Pond. This would require the import of riprap and embankment material, and construction of a 60-foot-wide temporary haul road. A description of riprap and embankment material sources and the haul road is presented above in the discussion of the Northwest and Southwest Evaporation Ponds.

*<u>Area that Would be Affected by North Wetland Habitat</u>***.** No archaeological or architectural resources have been recorded within the 1,200-acre APE of the North Wetland Habitat. However, none of this area has been surveyed for cultural resources, and the potential exists for archaeological materials to be encountered in both the inundated and shoreline portions of the APE during construction.

*<u>Area that Would be Affected by South Shore Displacement Dike</u>***.** No cultural resources surveys have been conducted within the 15,975-acre APE of the South Shore Displacement Dike. One precontact archaeological site and three geological localities with potential cultural associations have been recorded. The precontact archaeological site is a northwest/southeast-trending ethnographic trail. NRHP eligibility for this site has not been determined. Two of the geological localities are salt deposits recorded by H. S. Washburn of the U.S. General Land Office during a survey of the Salton Sink in 1856. The third geological locality was recorded as a mud volcano by Washburn. No cultural resources have been recorded in association with these localities, one of which is currently inundated by the Sea. However, it is likely that they were of some importance to occupants of the area, and the potential exists for precontact or post-contact archaeological materials to be found nearby.

Obsidian Butte, an important precontact lithic source, is located near the center of the southeastern boundary of the South Shore Displacement Dike APE. The potential exists for precontact archaeological materials to be encountered in the vicinity of this topographic feature.

Construction of the dike would require the import of riprap and embankment material, and construction of a temporary haul road. A description of riprap and embankment material sources and the haul road is presented above in the discussion of the Northwest and Southwest Evaporation Ponds.

*<u>Area that Would be Affected by Enhanced Evaporation System (EES) Near Bombay Beach</u>***.** Seven archaeological sites have been recorded within the EES-Bombay Beach APE. Five of the sites are precontact, one is post-contact, and one is multi-component. One of the precontact sites is an activity locus, and four are habitation sites of various sizes. The multi-component site, which is predominantly precontact, is a limited habitation site. The post-contact site is an activity locus of unknown function. One of the precontact habitation sites has been determined to be eligible for listing on the NRHP. The NRHP eligibility of the other five sites has not been determined.

Of the 10,880 acres that make up the APE for the Bombay Beach EES, only 2.7 percent, or 289.1 acres, have been previously surveyed for cultural resources. The potential exists for additional archaeological sites to be found within the unsurveyed portions of the APE.

The EES system near Bombay Beach would include an intake structure, consisting of a pipe 87 inches in diameter, that would extend into the Sea and be buried between the shoreline and the EES site. The potential exists for additional archaeological sites to be encountered on the sea bottom in the area to be affected by the intake structure, as well as on dry land where the connecting pipeline will be buried between the shoreline and the EES site. In addition, high-power electrical lines that currently traverse the EES site would have to be relocated. The potential exists for previously unrecorded archaeological sites to be encountered during that operation.

Area that Would be Affected by Flood Flows. Periodic augmentation of inflow into the Salton Sea using Colorado River flood flows would involve using the Alamo River and Salt Creek as conveyance facilities. Increasing the flow of water may result in erosion of river and creek banks. Cultural resources data have not been collected as part of the current project for the majority of this APE, which would lie outside the five-mile buffer zone of the Sea. However, there is a potential for archaeological sites to exist near the banks of both the Alamo River and Salt Creek.

Areas that Would be Affected by EES at Test Base Facility. Approximately 3,624 acres, or 32.6 percent, of the 11,112-acre EES-Test Base APE have been previously surveyed for cultural resources. Of the 172 archaeological sites that have been recorded, 154 (89.6%) are precontact sites, 3 (1.7%) are post-contact sites, 12 (7%) are multi-component sites, and 3 sites (1.7%) are of undetermined age. Of the 154 precontact sites, 87 (56.5%) are activity loci, and 67 (43.5%) are habitation sites. Thirty-three of the 67 habitation sites (49.3%) are temporary camps, 31 (46.3%) are limited habitation sites, and 3 (4.4%) are large habitation sites.

Because the Test Base area has been protected from modern disturbances by being enclosed as a military facility, many of the archaeological sites within its boundaries retain a high degree of integrity. Due to their proximity to the Salton Sea, they also maintain the important relationship to a lakeshore setting (Apple et al. 1997).

Ninety-one precontact sites within the Salton Sea Test Base have been recommended eligible for listing on the NRHP under Criterion A because of their relationship to the periodic filling and recession of Ancient Lake Cahuilla, which is important to regional precontact history. These sites also are eligible under Criterion D for the information they can contribute on regional research issues, including chronology, technology, subsistence, settlement and mobility, and cultural affiliation (Apple et al. 1997).

Seventy-five of the National Register-eligible precontact sites, located on and around a low sandstone ridge roughly parallel to the Salton Sea shoreline near the center of the Test Base, have been recommended as contributing elements to a National Register archaeological district. These sites have good integrity, as well as sufficient data potential to address regionally important research questions. The Southwest Lake Cahuilla Recessional Shoreline Archaeological District would encompass approximately 2,700 acres and would contain, in addition to the 75 NRHP-eligible sites, 35 noncontributing precontact sites. These 35 sites have poor integrity or lack significant data potential. National Register and state district forms have been completed in support of this archaeological district (Apple et al. 1997).

Very little remains of the buildings and other facilities constructed at the Test Base during World War II and the Cold War. Some of the buildings, along with the original runway, were inundated by the rising Sea level during the 1950s. After the base was placed on caretaker status in 1961, the Navy used its buildings for training exercises for several years, resulting in extensive damage. Most of the buildings were demolished because they had become unsafe. The remaining seven buildings—a weapons assembly facility, two magazines, a warehouse, a photography laboratory, and two water treatment structures—were all built between 1948 and 1954. The warehouse and the photography laboratory are half submerged in the Salton Sea. All of the buildings have been badly damaged by training exercises, weather, and neglect. Evaluation of the buildings found them to lack the historic associations, architectural distinction, and integrity necessary to make them eligible for listing on the National Register (Apple et al. 1997).

Area that Would be Affected by EES within Evaporation Pond at Test Base. This action would use the same Northwest Evaporation Pond described above, with the addition of portable blowers to spray Salton Sea water into the air within the pond. Two precontact archaeological sites, consisting of an activity locus and a temporary camp, have been recorded within the APE of the Northwest Evaporation Pond. Additional archaeological sites may be encountered if facilities for the portable blowers are to be constructed.

Construction of the pond would require the import of riprap and embankment material, and construction of a temporary haul road. A description of riprap and embankment material sources and the haul road is presented above in the discussion of the Northwest and Southwest Evaporation Ponds.

Ethnographic Resources. To identify Native American resources that may be affected by the restoration alternatives, Reclamation sent letters regarding the Salton Sea Restoration Project to 29 tribal organizations in California and Arizona. All of the groups received follow-up contacts by Reclamation's ethnographic contractor via telephone, facsimile, electronic mail, and/or letters. Twenty-seven of the contacted groups responded by telephone or letter stating their perspectives regarding proposed activities for the Salton Sea Restoration Project. Of these, 22 groups stated that they have no direct concerns regarding the project, 1 group has stated specific concerns (the Torres Martinez Desert Cahuilla), and 4 have expressed that they may have concerns, but have not formally stated any specific concerns. All of these 27 groups, regardless of their response, still wish to be involved in the consultation process and kept informed of any future project changes or further developments. Several groups have also stated that they would like to participate in monitoring of sensitive areas. Two groups have not yet responded to the consultation letters or follow-up contacts made to them. Table 3.16-4 lists the contacted groups, and their general response.

The Kumeyaay Cultural Repatriation Committee (KCRC) was also contacted during data gathering efforts at the urging of several of the Kumeyaay groups initially contacted. KCRC responded by letter stating that they should be contacted immediately if human remains or burial goods are found during any construction activities. Five of the members of KCRC (Ewiiaapaayp, Inaja, Manzanita, Santa Ysabel, and Viejas) also responded separately from the committee by stating that they had no comments/concerns at this time, but would like to be kept notified of the project as it proceeds.

The Torres Martinez Desert Cahuilla Indians have expressed several concerns regarding cultural and ethnographic resources in and around the Salton Sea that may be affected by restoration efforts. The Torres Martinez have expressed concern for archaeological sites located on the U.S. Navy Test Base. Although not considered TCPs or TUAs, these sites are considered by the Torres Martinez to be sensitve resources that require preservation. Furthermore, some of their concerns relate to potentially sacred sites that are currently submerged by the Salton Sea. They would like these sites to be protected, but are unsure of the exact locations of the sites.

The Torres Martinez are concerned with the protection of cultural resources located on their reservation that may be a affected by borrow sites, haul roads, and other activities that would involve ground disturbance on the reservation. These sites are also considered Indian Trust Assets and are discussed in Section 3.17.

During this process, Reclamation's ethnographic contractor encouraged the tribal groups to express any additional concerns not necessarily related to cultural resources. These additional concerns, as well as detailed descriptions of the consultation process and issues raised during the process, are documented in the

Table 3.16-4
List of Responses

Tribal Organization	Tribal Affiliation	General Response
Agua Caliente Tribal Council	Cahuilla	No concerns expressed[1]
Augustine Band of Mission Indians	Cahuilla	No concerns expressed[1]
Cabazon Band of Mission Indians	Cahuilla	No concerns expressed[1]
Cahuilla Band of Indians	Cahuilla	No response
Campo Band of Mission Indians	Tipai	No concerns expressed[1]
Chemehuevi Tribal Council	Chemehuevi	May have concerns[2]
Cocopah Tribal Office	Cocopah	May have concerns[2]
Colorado River Indian Tribes	Chemehuevi, Mohave	No concerns expressed[1]
Cuyapaipe Band of Mission Indians	Tipai	No concerns expressed[1]
Ft. McDowell Mohave-Apache Community Council	Apache, Mohave	No concerns expressed[1]
Ft. Mojave Tribal Council	Mohave	No concerns expressed[1]
Inaja-Cosmit Band of Mission Indians	Ipai-Tipai	No concerns expressed[1]
Jamul Indian Village	Tipai	No concerns expressed[1]
Kumeyaay Cultural Repatriation Committee	Kumeyaay	No concerns expressed[1]

La Jolla Indian Reservation	Luiseño	No concerns expressed[1]
La Posta Band of Mission Indians	Tipai	No concerns expressed[1]
Los Coyotes Band of Indians	Cahuilla	No concerns expressed[1]
Manzanita General Council	Tipai	No concerns expressed[1]
Morongo Band	Cahuilla, Cupeño, Serrano	May have concerns[2]
Pala Band of Mission Indians	Ipai, Cupeño, Luiseño	No concerns expressed[1]
Quechan Tribal Council	Quechan	May have concerns[2]
Ramona Band of Indians	Cahuilla	No concerns expressed[1]
Santa Rosa Band of Mission Indians	Cahuilla	No response
Santa Ysabel Band of Diegueno Indians	Ipai-Tipai	No concerns expressed[1]
Soboba Band of Mission Indians	Cahuilla, Luiseño	No concerns expressed[1]
Sycuan Business Committee	Tipai	No concerns expressed[1]
Torres Martinez Desert Cahuilla Indians	Cahuilla	Have specific concerns
Twenty Nine Palms Band of Mission Indians	Chemehuevi, Luiseño	No concerns expressed[1]
Viejas Band of Mission Indians	Ipai-Tipai	No concerns expressed[1]

Notes: [1]While no specific concerns have been expressed, these groups wish to remain involved in the consultuation process. [2]These groups have stated that they may have concerns, but have not indentified any specific concerns and have not provided further information.

summary report titled *Salton Sea Restoration Project: Contacts with Native American Groups* (Smith et al. 1999b).

3.16.4 Regulatory Background

Archaeological and Architectural Resources. Cultural resources are protected primarily through the NHPA of 1966 and its implementing regulation, Protection of Historic Properties (36 CFR § 800); the Archaeological and Historic Preservation Act; the Archaeological Resources Protection Act of 1979, and CEQA. Section 106 of the NHPA (16 USC 470-470w6) requires federal agencies to consider the effects of their actions on properties (i.e., sites, districts, buildings, structures, or objects) that are listed in or eligible for listing in the NRHP. Criteria for inclusion in the NRHP (36 CFR 60.4) are as follows:

- Association with events that have made a significant contribution to the broad patterns of our history;
- Association with the lives of persons significant to our past;
- Resources that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Resources that have yielded or may be likely to yield information important in prehistory or history.

In addition to historic significance, a property must have integrity to be eligible to the NRHP. Integrity is the property's ability to convey its demonstrated historical significance. Seven individual elements make up integrity: location, design, setting, materials, workmanship, feeling, and association. The implementing regulations of the NHPA (36 CFR § 800) require federal agencies to provide the SHPO with an opportunity to comment on any actions that may affect a historic property and to provide the ACHP with an opportunity to comment on any action that will adversely affect a historic property.

CEQA requires state agencies to consider the effects of their actions on historically significant resources, which are those that meet the criteria for listing in the CRHR or a local register of historical resources. Criteria for inclusion in the CRHR are provided in Section 15064.5 of CEQA and are similar to the criteria for inclusion in the NRHP, described above.

Ethnographic Resources. Section 101(d)(6)(A) of the NHPA, as amended (1992), provides for properties of traditional religious and cultural importance to a tribe to be determined eligible for inclusion in the NRHP. National Register Bulletin 38 *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1990) provides guidance on identifying, evaluating, and documenting ethnographic and other cultural resources that may qualify for listing on the National Register as TCPs. In order for a resource to be eligible for consideration as a TCP it must meet the age criterion for listing and be "…eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King 1990:1). Some resources may not meet the criteria for consideration as a TCP, but are considered sacred by Native American traditional practitioners. Executive Order (EO) 13007 defines a sacred site as "…any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion." EO 13007 directs Federal agencies, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and ceremonial use of such sites, and to avoid adversely affecting their physical integrity. The American Indian Religious Freedom Act (AIRFA) of 1978 states that it is the policy of the United States to protect and preserve for Native Americans the inherent right to believe, express, and exercise their traditional religions, including but not limited to access to religious sites, use and possession of scared objects, and freedom to worship through ceremonials and traditional rites. The courts have determined that there is a compliance element implied within AIRFA that requires Federal agencies to obtain the views of tribal leaders and to consider these when a proposed land use might conflict with traditional religious beliefs or practices. The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, directs Federal agencies to consult with tribes concerning the repatriation or disposition of human remains, funerary objects, sacred objects, and objects of cultural patrimony, in the agency's possession that are housed in museums, or have come under the agency's control as a result of intentional excavation or inadvertent discovery. The procedures established in NAGPRA and its implementing regulations as found at 43 CFR §10, must be followed when remains covered by the Act are found on tribal or Federal lands. If human remains are discovered on land that is not under Federal or tribal jurisdiction, the agency is required to follow state and local law. Provisions for the discovery of Native American human remains in California can be found in Section 15064.5 (d) of the California Environmental Quality Act (CEQA).

3.17 INDIAN TRUST ASSETS

Indian Trust Assets (ITAs) are legal interests in assets held in trust by the federal government for Indian tribes or individuals. Assets can be real property, physical assets, or intangible property rights. ITAs cannot be sold, leased, or otherwise encumbered without the approval of the US government. A trust relationship is established through a congressional act or executive order, as well as by provisions identified in historic treaties. As trustee, the Department of the Interior is legally obligated to fulfill treaty and statutory obligations and to manage, protect, and conserve Indian resources and lands in utmost good faith.

Land associated with a reservation, rancheria, or public domain allotment is an example of an ITA. Resources located within reservations, including timber, minerals, oil and gas, and others, also are considered trust assets. Treaty rights and water rights, as well as hunting and fishing rights, may also be ITAs. Additional assets consist of financial assets in trust accounts.

The Salton Sea Restoration Project is not likely to affect trust assets that consist of money or financial accounts but may affect land assets or rights associated with land assets. Therefore, the focus of the following section is on land assets or rights that could be affected by restoration activities. Financial assets, such as trust accounts, would not be subject to impacts and are not considered in this document.

3.17.1 Identification Methods

BIA is charged by the Department of Interior with developing inventory listings for the ITAs of all tribes. Due to a lack of funding, these lists are not yet complete. The Bureau of Reclamation Indian Trust Asset Policy and NEPA Implementing Procedures dated August 31, 1994, direct that the following sources should be consulted to obtain information concerning extant ITAs: potentially affected tribes or Indian individuals, the Solicitor's Office, the BIA, the Native American Affairs Office, or the regional Native American Affairs Coordinator. All of these entities have been consulted concerning ITAs in the Salton Sea Restoration Project area.

3.17.2 Existing Conditions

Reservations and Land Assets. One reservation with real property trust assets has been identified within the project scope of Phase 1 of the Salton Sea Restoration Project. The Torres Martinez Desert Cahuilla Indian Reservation has a population of 198 (Torres Martinez Tribal Council 1999a, b) and is located on 24,024 acres along the northwestern shore of the Salton Sea (Tiller 1995). Approximately 11,800 acres of the reservation is currently inundated by the Salton Sea (Cox 1999). The Torres Martinez Desert Cahuilla Indians have sought damages and compensation for lands claimed to be inundated or damaged by the Salton Sea. The Southern California Agency of the BIA Realty Office did not identify any public domain allotments under BIA jurisdiction in Imperial County or within a five-mile radius of the Salton Sea in Riverside County. According to this office, no other lands are held in trust by the Bureau of Indian Affairs for Indian groups in the project area surrounding the Salton Sea. The Arizona BIA also did not identify any ITAs within the project area.

Water Rights. The Torres Martinez Desert Cahuilla Indians may have existing water rights held in trust by the United States. In 1908, the US Supreme Court (Winters v. United States, 207 US 564) ruled that when Congress created Indian reservations, water rights needed to develop and support these reservations were reserved. The Winters Doctrine has been extended by rulings of the US Supreme Court to include ground water rights as well as surface water rights (Foster 1978). Additional Federal and State reserved water rights are provided through Executive Orders, Supreme Court decisions, and statutes and regulations, which may all apply to the Torres Martinez reservation. The Torres Martinez have stated that a lawyer is working on their behalf to examine the issue of potential water rights (Torres Martinez Tribal Council 1999b).

Hunting and Fishing Rights. No specific hunting or fishing rights other than those granted to all citizens with proper permits from the CDFG have been identified in the project area. Under Public Law 280, the CDFG regulates fishing and hunting both on and off reservations. The Torres Martinez report that a lawyer is working on their behalf to identify potential hunting and fishing rights (Torres Martinez Tribal Council 1999b).

Mineral Rights. Significant gold deposits have been located on the Torres Martinez Reservation (Bureau of Indian Affairs 1999). This gold may be accessible via open-pit or underground target methods of extraction. As a trust asset, impacts to these resources should be considered. The Indian Minerals Development Act (PL 97-382, 25 USC 2101) and the Federal Oil and Gas Royalty Management Act of 1982 (PL 97-451) indicate that information relating to mineral development of Indian Trust lands are proprietary to the individual tribe and not to be disclosed without consent.

Cultural Resources. The Torres Martinez Desert Cahuilla Indians have indicated that they consider cultural resources located within the Torres Martinez Reservation to be Indian Trust Assets (Torres Martinez Tribal Council 1999b). Reclamation's Indian Trust Asset Policy and NEPA Implementing Procedures (1994) indicate that cultural resources on tribal lands are frequently considered Indian Trust Assets. Currently, 66 archaeological resources are known to exist on the Torres Martinez Reservation. Of these, 60 (90%) are precontact resources. These consist mainly of fish traps, trails, rock features, lithic scatters, and house pits/rings, as well as 2 rock shelters/caves, 1 petroglyph, and 1 grave circle. Five (8%) of the sites on the reservation consist of post-contact resources, including three wagon roads, one refuse concentration, and portions of the Coachella Canal, built in 1948. The 1 remaining resource (2%) is a multicomponent site containing precontact materials and the Torres Martinez Reservation Agency Building, which is listed on the NRHP as a contributing element to the Martinez Historical District. All 66 of these cultural resources, as well as any unidentified resources, are likely to be considered Indian Trust Assets.

Under the definition of Indian Trust Assets, cultural resources located off the Torres Martinez Reservation are unlikely to be considered trust assets of the Torres Martinez. Such resources, however, may be considered traditional cultural properties or traditional use areas and are discussed separately in Section 3.16 under Ethnographic Resources.

3.17.3 Regulatory Background

The Department of the Interior Order No. 3175 requires all Department of Interior bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision, and operation documents. This order also requires appropriate descriptions of how decisions will conform to the Department's trust responsibilities. On July 2, 1993, Reclamation adopted its Indian Trust Asset Policy, which states that Reclamation would seek to protect or avoid adverse impacts to ITAs. When adverse impacts cannot be avoided, Reclamation will provide for an appropriate mitigation or compensation. This policy also states that Reclamation will not engage in a Fifth Amendment taking of ITAs without statutory authority and adequate compensation. In consultation with the

Office of the American Indian Trust, the Indian Trust Asset Policy was determined adequate to comply with Departmental Order No. 3175.

Reclamation policy (Reclamation 1994) advises that a NEPA document must state clearly the United States' position when a resource in question is not considered an ITA. If disputed by an Indian group, the group's position also must be clearly outlined.

3.18 PALEONTOLOGICAL RESOURCES

Paleontological resources are the recognizable remains of once-living, nonhuman organisms and early hominids. Identified as fossils, these resources represent a record of the history of life on the planet dating as far back as +/- 4 billion years ago. Paleontological resources can include shells, bones, leaves, tracks, trails, and other fossilized floral or faunal materials (National Research Council 1987). These resources provide valuable information on evolution, climatology, and taxonomy and can provide information for measuring time in earth history, as well as for understanding ancient environments and geographies (National Research Council 1987; Science Applications International Corporation 1994).

3.18.1 Identification Methods

Paleontological resources are fossilized remains of once living, non-human organisms and early hominids that have been incorporated into specific geological formations (National Research Council 1987). By understanding where particular geological formations within a project area occur, predictions can be made where fossil resources are likely to be found. Fossil localities, as discussed in this document, are specific locales where fossils have been identified and formally documented. These localities are not the only paleontological resources that may exist within a given area.

To assess where fossil-containing geological formations occur within the project area, published geological maps by Rogers (1965), Jennings (1967), and Morton (1977) were consulted. These maps identified at least four sensitive fossil-bearing geological formations within the project area (Palm Springs, Borrego, and Brawley Formations, and the Lake Cahuilla Deposits). Research was conducted at the University of California at Riverside Science Library and via University of California Internet reference resources. Additionally, the University of California Museum of Paleontology specimen catalog was queried to identify any paleontological specimens that may have been collected from the Salton Sea project area.

A record search was also conducted through the Regional Paleontological Locality Inventory (RPLI) of the San Bernardino County Museum. This computer database contains the contextual data of more than 3,000 fossil localities in California and the southwestern United States. Records were searched for 19 USGS topographic 7.5' quadrangle maps for areas within a five-mile buffer area surrounding the Salton Sea.

3.18.2 Known Resources

Fossil resources near the Salton Sea are predominantly from Pliocene and Pleistocene sediments representing both lake and terrestrial habitats. These sediments contain a myriad of fossil vertebrate and invertebrate specimens, including terrestrial mammals associated with the transition into the Pleistocene Epoch. Saber-toothed cats (*Smilodon* sp.), mammoths (*Mammuthu*s sp.), camels (*Camelops* sp.), horses (*Equus* sp.), ground sloths (*Glossotherium* sp.), and bison (*Bison antiquus*) have been found in these geologic contexts. Lake habitat vertebrates that have been found include fish, turtles, and various kinds of reptiles associated with the ancient lake shoreline. The search of the RPLI revealed 91 known fossil localities on the 19 quadrangles examined within a five-mile buffer area around the Salton Sea shoreline.

Several major geologic formations of the Salton Basin are especially important to the paleontology of this region, including the Palm Springs, Borrego, and Brawley Formations, and the Lake Cahuilla Deposits. These geologic layers bear fossils that relate to the environmental conditions under which they were formed.

The Palm Springs Formation consists of pink-gray laminated sandstone that was formed during the Pliocene and Pleistocene in coastal floodplain conditions. The beds are believed to have been deposited between 4 to 1.5 million years ago. Vertebrate fossils found within the Palm Springs Formation include camels, llamas, horses, donkeys, mammoths, mastodons, sloths, zebras, lions, sabertooth cats, and bears (Scheonherr 1992). RPLI records indicate several Palm Springs Formation Pleistocene fossil localities within the five-mile buffer area surrounding the Salton Sea; however, none of these localities fall directly within the project areas.

The Borrego Formation is composed of gray clay, interbedded sandstone, and fossils of mollusks, ostacods, and Foraminifera (Morton 1977). These fossils are related to ancient lake habitats that existed during the Pliocene and Pleistocene. This formation is thought to be the lacustrine equivalent of the Palm Springs Formation (Jennings 1967).

The Brawley Formation consists of sediments deposited during the Pleistocene in both lake and terrestrial habitats (Downs and Woodard 1961; Morton 1977). Fossils from the Rancholabrean Land Mammal Age have been collected from this formation in several locations in Imperial County. Taxa previously recorded include mammoth, deer (*Cervidae*), horse, camel, and bison (Jefferson 1991b). Other Brawley Formation localities in Imperial County have produced Razorback sucker (*Xyrauchen texanus*), Bonytail (*Gila elegans*), Western Pond Turtle (*Clemmys marmorata)*, Teleosts, and Iguanidae (Jefferson 1991a).

The Brawley Formation extends into the project area in the Bat Caves Buttes area north of Bombay Beach and in the western portion of the Salton Sea Test Base. RPLI records indicate 29 fossil localities are present in the Bat Caves Buttes area. Fossils recovered have been of both vertebrate and invertebrate taxa, including pelecypods, gastropods, freshwater mussel (*Anodonta* sp.), and freshwater clam (*Corbicula* sp.). Five localities containing Brawley Formation fossils have been located inside the Bombay Beach EES project area.

The Lake Cahuilla Deposits consist of deposits formed on the shores and bottom of ancient Lake Cahuilla and are known to contain abundant nonmarine fossils (Jennings 1967). The animals living during this time were similar to those found within the Brawley Formation, some of which still exist today. Shellfish and Colorado River fish, including freshwater mussel, gastropods, freshwater clams, Razorback suckers, and Bonytails were abundant during stands of ancient Lake Cahuilla.

3.18.3 Regulatory Background

Reclamation is required under CEQA to take into consideration the potential impacts from this project on important paleontological resources. If actions of Reclamation affect lands administrated by the BLM, Reclamation must comply with statutes and regulations applying to BLM lands. This includes three statutes (Federal Land Policy and Management Act, Federal Caves Resources Protection Act, and the Crimes and Criminal Procedures 18 U.S.C. 641), and eleven regulations (43 CRF Parts 37, 1610, 3610, 3621, 3622, 3802, 3809, 8200, 8365, 3802, 3809). If an action will effect fossils on lands under the jurisdiction of other Federal agencies, such as the Department of Defense, Reclamation must meet the statutory and regulatory requirements of those agencies. When an action is likely to effect fossils on non-federal lands, Reclamation is required to adhere to the provisions of state and local statutes.

3.19 ENVIRONMENTAL JUSTICE

3.19.1 Introduction

The President of the United States issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations, on February 11, 1994. Objectives of the executive order include developing federal agency implementation strategies, identifying minority and low-income populations where proposed federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process. Consideration of Environmental Justice issues is a federal requirement; there is no corresponding CEQA counterpart or significance criterion.

Executive Order 12898 provides minority and low-income populations with an opportunity to comment on the development and design of Reclamation activities. Reclamation issued the Environmental Compliance Memoranda on Environmental Justice and Trust Resources **(Source? TBS**), which revises the NEPA guidance, to require the incorporation of Environmental Justice concerns into the NEPA processes. It makes Environmental Justice a part of the mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority and low-income populations.

A demographic analysis provides information on the approximate locations of minority and low-income populations in areas potentially affected by the proposed action and alternatives. Affected areas could include, for example, a dike construction staging area located adjacent to the Salton Sea.

Geographic boundaries of census block groups have been determined using US Topographically Integrated Geographic Encoding and Referencing files. Data that is associated with each census block group is listed using the 1990 US Census of Population, which reports numbers of both minority residents and residents below poverty levels.

The US Bureau of the Census identifies four racial classifications: white, black, American Indian, Eskimo, or Aleut, and Asian or Pacific Islander. The US Bureau of the Census does not consider Hispanic a race; it is considered an origin.

Low-income populations are those living within a census block group whose income is below the poverty level. Households are classified as being below the poverty level if their total family income or unrelated individual income is less than the poverty threshold specified for the applicable family size. For example, the weighted average threshold for a four-person family is $12,674 for the 1990 census. This reflects the different consumption requirements of families based on their size and composition (US Bureau of the Census 1994).

3.19.2 Existing Conditions

To determine whether the census block groups potentially affected have high minority or low-income populations, the percentage of each of these groups in each census block group around the Salton Sea has been compared to the county population in which it is located (Table 3.19-1). Minority populations and low-income populations are separate groups, and a comparison has been made for each. When the census block group minority or low-income population is higher than the county population, the census block group is considered to be a minority or low-income community for the purpose of this analysis and is shaded in Table 3.19-1.

To establish areas of environmental justice impacts, a preliminary delineation of the potentially affected populations is performed in this section, then potential impacts in all resource areas are analyzed with respect to the potentially affected populations. The significance criteria are as follows:

- Does the potentially affected community include minority or low-income populations?
- Are significantly adverse environmental or human health impacts likely to fall disproportionately on these minority or low-income populations?

Significant Environmental Justice impacts would result only if implementation of the proposed action or an alternative produces disproportionate significant adverse environmental or human health impacts to the low-income or minority population communities that have been profiled.

Table 3.19-1
Census Block Groups
Low-income and Minority Populations
Riverside County and Imperial County*

Counties and Block Groups	Total Population	Below Poverty Line (%)	Black (%)	American Indian, Eskimo, and Aleut (%)	Asian and Pacific Islander (%)	Hispanic Origin (%)
Riverside County	1,170,413	11.5	5.4	1.0	3.6	26.3
650456.02:3	4,242	36.0	0.0	0.2	2.2	94.2
650456.02:2	2,838	46.6	0.6	1.7	3.1	91.2
650456.02:4	631	22.7	0.5	1.0	1.4	32.3
Imperial County	109,303	23.8	2.4	1.7	2.0	65.8
250124.00:3	484	27.1	5.0	0.6	0.4	2.7
250123.02:3	40	0.0	0.0	0.0	0.0	12.5
250123.02:2	541	9.6	2.0	1.5	0.9	6.5
250123.02:1	637	4.6	0.3	0.9	0.2	14.4
250123.02:5	159	18.2	0.6	0.0	1.3	10.7
250123.02:6	325	3.7	1.5	0.0	0.3	3.1
250123.02:9	35	0.0	0.0	0.0	0.0	42.9
250101.00:6	428	38.6	0.2	2.1	4.7	44.9
250124.00:4	337	21.7	13.1	0.6	0.3	2.7
250123.02:4	47	0.0	0.0	0.0	0.0	17.0
250123.02:7	126	34.1	1.6	1.6	0.0	9.5
250123.02:8	43	0.0	0.0	0.0	0.0	4.7
250102.00:1	221	29.9	2.3	0.5	4.1	53.8

*Shaded areas indicate that the US Census block group has a higher percentage of poverty or minority populations than its respective county.
Sources: Hall and Gaquin 1997; US Bureau of the Census 1991, 1993.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES OF PHASE 1 ACTIONS

The CEQ regulations for implementing NEPA state that "the discussion will include the environmental impacts of the alternatives including the proposed action, [and] any adverse environmental effects which cannot be avoided should the proposal be implemented . . . " (40 CFR 1502.16). The discussion should include direct and indirect effects and their significance. The significance of an impact should be evaluated in consideration of the context and intensity of the effect. Likewise, the Guidelines for Implementation of CEQA state that "An EIR shall identify and focus on the significant environmental effects of the proposed project" (14 CCR, Article 9, Section 15126.2). The cumulative effect of the action with other past, present, and reasonably foreseeable future actions also must be considered.

The discussions of the environmental consequences of Phase 1 of the Salton Sea Restoration Program covering all aspects of the human environment are provided here in the same order of resources as discussed for the affected environment in Chapter 3. The environmental consequences of each Phase 1 alternative, including No Action, are included. Discussions of the environmental consequences of Phase 1 common actions are provided in Chapter 5, and the environmental consequences of Phase 2 actions are discussed in Chapter 6.

4.1 SURFACE WATER RESOURCES

4.1.1 Summary of Environmental Consequences

For the No Action Alternative with continuation of existing inflows, salinity would continue to rise at a nearly constant rate, as the elevation would gradually increase. The current elevation is –227 ft msl. At current inflows, the rate of evaporation is approximately equal to the rate of inflow (5.78 ft/yr evaporation equals about 1.36 maf/yr at the current Sea elevation). By 2030, the salt concentration of the Sea would increase from the current value of around 44,000 mg/L to approximately 53,000 mg/L.

As salinity increases, the rate of evaporation per unit area decreases slightly, causing the Sea to rise in elevation. Elevation would gradually rise from –227 ft msl to –226 ft msl by 2030.

With reduced inflows, the rate of evaporation would exceed the rate of inflow, and the Sea level would decline until a new balance is achieved. The amount of salt added to the Sea each year would decrease slightly with the reduced inflows. However, the combination of a shrinking Sea and continued inflow of salts would cause the salinity to rise much faster than it would under current inflows. If the annual inflow is gradually reduced to 1.06 maf/yr by the end of Phase 1, the elevation of the Sea would reach –234 ft msl, and the salinity would increase to over 75,000 mg/L.

In addition to the salinity increase, the concentration of nutrients and other constituents that are carried into the Sea also would increase. Many of these nutrients are processed by organisms that live in the water column or in the bottom sediments of the Sea. Much of the waste produced by these organisms is ultimately deposited on the bottom, and some is converted to gasses that escape into the atmosphere. As the salts and nutrients accumulate in the Sea, the biological community would evolve. The changes in the biological community may affect water quality by altering the rate at which nutrients and certain mineral salts are removed from the water column.

Slight declines in elevation would not substantially change the general circulation pattern of the Sea. However, further declines might affect the rate of change in temperature, increase the velocity of wind-driven currents in certain areas, and increase the hydraulic separation of the northern basin from the southern basin.

Alternative 1 would reduce the volume and surface area of the Sea, displacing part of the Sea with concentration ponds. If the average annual inflow to the Sea continues at its current value of 1.36 maf/yr, the elevation of the Sea is projected to reach -229 ft msl by 2030. The salinity at that time is projected to be about 37,000 mg/L compared to 53,000 mg/L for the No Action Alternative. If the average annual inflow declines to 1.06 maf/yr, the elevation is projected to reach –237 ft msl for Alternative 1. For this case, the salinity is projected to be about 46,000 mg/L in 2030 compared to 75,000 mg/L for the No Action Alternative with reduced inflows. A significant adverse impact on water quality would occur if the ponds were to breach and the brine contained in them were to drain into the Sea.

Alternatives 2 and 3 would have identical impacts on elevation and water quality. If the average annual inflow to the Sea continues at its current value of 1.36 maf/yr, the elevation of the Sea is projected reach -232 ft msl by 2030. The salinity at that time is projected to be about 45,500 mg/L. If the average annual inflow declines to 1.06 maf/yr, the elevation is projected to reach –237 ft msl for either Alternative 2 or 3. For this case, the salinity is projected to be about 54,000 mg/L in 2030 compared to 75,000 mg/L for the No Action Alternative with reduced inflows.

Alternative 4 would combine an EES with concentration ponds. If the average annual inflow to the Sea continues at its current value of 1.36 maf/yr, the elevation of the Sea is projected reach -229 ft msl by 2030. The salinity at that time is projected to be close to 40,000 mg/L compared to 53,000 mg/L for the No Action Alternative. If the average annual inflow declines to 1.06 maf/yr, the elevation is projected to reach –235 ft msl for Alternative 4. For this case, the salinity is projected to be about 47,000 mg/L in 2030 compared to 75,000 mg/L for the No Action Alternative with reduced inflows.

Alternative 5 would combine a concentration ponds with an in-Sea EES. If the average annual inflow to the Sea continues at its current value of 1.36 maf/yr, the elevation of the Sea is projected reach -232 ft msl by 2030. The salinity at that time is projected to be about 41,000 mg/L compared to 53,000 mg/L for the No Action Alternative. If the average annual inflow declines to 1.06 maf/yr, the elevation is projected to reach –236 ft msl for Alternative 5. For this case, the salinity is projected to be about 46,000 mg/L in 2030 compared to 75,000 mg/L for the No Action Alternative with reduced inflows.

4.1.2 Significance Criteria

Impacts on surface water resources include changes in water quality, changes in the quantity of water available for existing or potential beneficial uses, changes in hydraulic conditions (for example, changes in depth or configuration of the Sea that could affect current velocity, mixing, sediment deposition, or other limnologic processes), and changes in drainage patterns that increase the potential for flooding or desiccation of existing wetlands. In general, change is measured relative to existing conditions and then with respect to expected conditions if the project is not implemented (No Action Alternative). Inflows to the Salton Sea are highly dependent on the amount of water imported to the Salton Sea Basin from the Colorado River. Current inflow to the Salton Sea has been defined as an average of 1.36 maf/yr of water entering the Salton Sea, based on the historical average inflow during the past 50 years.

Impacts are judged to be significant if they result in noncompliance with existing regulatory standards, plans, or policies. See Chapter 9 for a discussion of the applicable regulatory standards. Otherwise, the significance is based on the degree of harm they may cause to people or the environment. In general, any degradation of water quality that may reduce the existing or potential beneficial uses of the water is considered significant. The significance of a reduction in the quantity of water available for beneficial uses depends on the size, timing, duration, and permanence of the reduction. The significance of changes in hydraulic conditions depends on the context in which the change occurs. Increased flooding potential is deemed significant if it increases the 100-year flood zone or if it could result in increased potential for injury, loss of life, or damage to existing structures or property. Desiccation is considered significant if it could result in a loss of wetlands.

4.1.3 Assessment Methods

Quantitative versus Qualitative Methods. Two quantitative mathematical modeling tools were used to evaluate the potential effects of the alternatives on future conditions. A spreadsheet-based mass-balance and water budget accounting model, the Salton Sea

Accounting Model, was used to predict the range of future effects of the alternatives on salinity, elevation, and surface area of the Sea. The UC Davis Hydrodynamic Model of the Salton Sea was used to estimate the effects of changes in Sea elevation. The modeling efforts described below represent the preliminary effort to quantify these effects. Further modeling may be conducted as the need arises or as the alternatives are further refined. However, the preliminary results provide a basis for identifying the principal effects.

Except for the results of this mathematical modeling, the impacts on water resources discussed in this section are based on professional judgment. In general, the hydrologic effects of the alternatives are expected to result in beneficial impacts on water resources relative to expected conditions if no action is taken. Where uncertainty exists in the choice of assumptions affecting future conditions, an attempt has been made to identify the range of potential effects, whether adverse or beneficial, and to focus on the causes.

Qualitative evaluation of impacts has been aided by consultation and input from members of the Salton Sea Science Subcommittee. This input was especially important due to the complexity and interconnectedness of physical and biological conditions within the Salton Sea ecosystem and because of the rapidly evolving scientific understanding of the physical and biological environment of the Sea. In this regard, the research being conducted under the supervision of the Science Subcommittee already represents an important part of the database available for describing and interpreting these conditions.

Salton Sea Accounting Model. The potential impacts of the project alternatives are assessed by comparison to existing conditions and to predicted conditions extended into the future, assuming that the project is not built (the No Action Alternative). A numerical model first developed by Thiery (1998) and significantly enhanced for the Salton Sea Restoration Project (Reclamation 1999b) was used to predict the salinity, elevation, and surface area of the Salton Sea over time. The most significant enhancement being a new ability to perform stochastic simulations. The model was used to predict how salinity, elevation, and surface area would change over time for the No Action Alternative and for the project alternatives. The planning horizon addressed by the model is 100 years.

A detailed description of the modeling process, assumptions, and results is presented in a document prepared by Reclamation (Weghorst 1999). A summary of the modeling assumptions and results is provided in this section, but the reader should consult the Reclamation document for further details.

The Salton Sea Accounting Model developed by Reclamation requires that certain input variables be defined by the user. The choice of values for these variables is based on certain assumptions about current and future conditions. The model then calculates the elevation, salinity, and surface area of the Salton Sea at the end of each year.

For modeling purposes, the concentration of dissolved salts in the inflow was assumed to change as a function of the annual inflow. Three average long-term inflow scenarios were modeled. The current average annual inflow was assumed to be 1.363 maf/yr (this value is rounded to 1.36 maf/yr in the remainder of this document). This assumption is based on the average historical inflow rate during the past 50 years. Two reduced inflow scenarios of 1.06 maf/yr and 0.8 maf/yr, as described in section 2.3 of chapter 2, were also modeled. For the current inflow rate of 1.36 maf/yr, the average annual dissolved salt concentration in the inflow was assumed to be 2,800 mg/L. For 1.06 maf/yr and 0.8 maf/yr, the average annual salt concentrations in the inflow were assumed to be 3,460 mg/L and 4,110 mg/L, respectively. This is based on the assumption that conservation measures would have the effect of concentrating salts in the inflow.

In the model, the inflow rate and salinity of the inflow can be varied each year. For the reduced inflow scenarios, the reductions would occur in 10,000 af (or 0.01 maf) annual increments, beginning in 2002. Based on this assumption, it would take 30 years to reduce the average annual inflow rate from 1.36 maf/yr to the intermediate reduced inflow rate of 1.06 maf/yr. After 30 years, no further reductions would occur in the 1.06 maf/yr scenario. For the maximum reduction in inflow, it would take an additional 26 years to reach an average inflow rate of 0.8 maf/yr, after which no further reductions would occur.

Historically, the inflow rate to the Salton Sea has varied from year to year. Average inflow rate over that 50-year period has remained fairly stable. In any one year, changes in cropping patterns, weather, municipal use, water use in the Mexicali Valley, or variations in the deliveries through the All American Canal cause the inflow rate to the Sea to vary. The historical record indicates that in 95 percent of the years the inflow rate will not be higher than 1.55 maf/yr or lower than 1.19 maf/yr.

This annual variation could be important to the successful design and implementation of a restoration alternative. Therefore, the modeling process took into account the historical variation. In addition to estimating the average future values of the salinity, elevation, and area over time, the model was designed to calculate the standard deviation from the mean and the upper and lower 95 percent confidence limits for each of the parameters simulated. The method used to obtain these statistical estimates is described further in the Reclamation (1999).

The accounting model has the ability to simulate the importation of flood flows, which are periodically available from the Colorado River. As with the other inflows discussed above, the amount of flood flows vary from year to year. In many years, no flood flows are available at all. The availability of flood flows in the future was estimated using probability distributions described in the Reclamation (1999).

The ability to import flood flows also depends on the availability of excess carrying capacity in the All American and Coachella canals. In order to ensure that available flood flows can be delivered to the Sea, an assumption was made that the total excess carrying capacity of the canals is 1,250 cfs over a four-month period. One thousand two-hundred and fifty cfs over a four-month period is equivalent to 300,000 af/yr. The annual volume of flood flows, between 0 and 300,000 af/yr, was determined from probability distributions for each year in the 100-year simulation period. The results were added to the probabilistically determined base inflow for each year corresponding to the appropriate inflow scenario (current or reduced conditions). The concentration of salts in the flood flows is assumed to be the maximum allowed at Imperial Dam, 800 mg/L.

The model assumes that the evaporation rate from the Sea depends on the salt concentration of the water. At higher salt concentrations, the evaporation rate decreases. The process is described in Reclamation (1999).

In modeling, an attempt was made to achieve the salinity and elevation objectives of the project as closely as possible. A target elevation of –232 ft msl was used for modeling purposes. Upon further refinement of the modeling process in the future, this value will likely be adjusted to –230 ft msl. The target salt concentration was set at 37,500 mg/L. The model simulations assume that the construction of the Phase 1 evaporation pond and/or EES facilities would be completed in 2008.

Hydrodynamic Modeling

Only preliminary simulations of the effects of the alternatives on hydrodynamic conditions in the Salton Sea have been performed to date. Model simulations have been performed to estimate changes in direction and speed of currents, and changes in temperature and salinity, under specific meteorological conditions. The simulations were performed to compare the horizontal component (plan view) of the current velocity field when the elevation of the Sea is reduced from –227 ft msl (current elevation) to –236 ft msl (approximate stable elevation when inflow is reduced under the No Action Alternative).

The model input assumptions, such as the particular sequence of wind velocities (speed and direction) and the estimated frictional and turbulence coefficients that were used to simulate the future reduced inflow condition were the same as assumed for calibrating the model to observed conditions. Wind velocity inputs were based on the measured data set for the period from October 8 to October 29, 1997. The effects of the tributary inflows, based on the level of inflow that existed during the calibration period, were included, but were not varied.

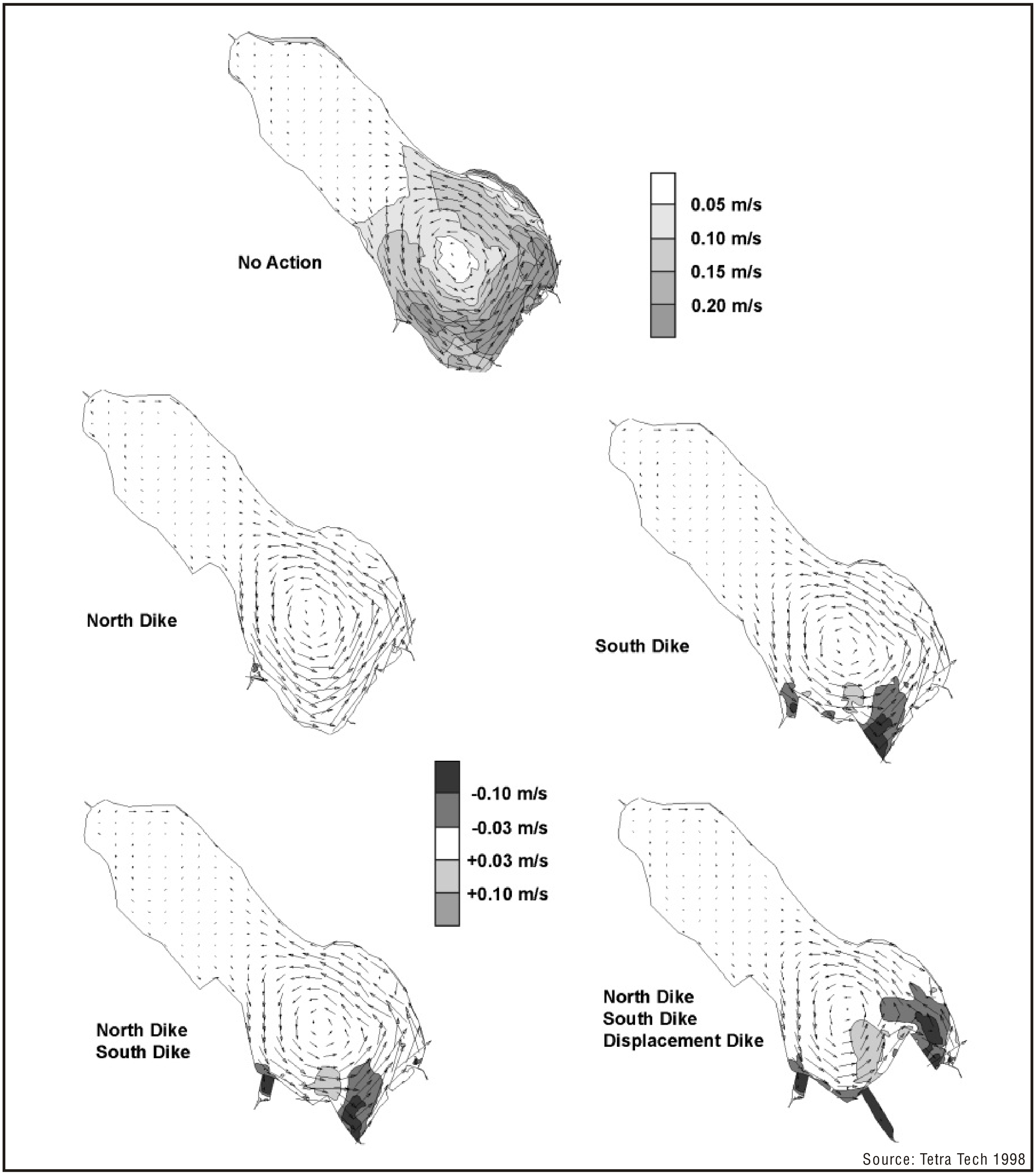
The shoreline boundaries were modified to approximate the shoreline configuration with the alternatives in place. Simulations were performed at the current elevation of –227 ft msl, for the No Action Alternative, with the North Concentration Pond dike in place, with the South Concentration Pond dike in place, with both the North and South Concentration Pond dikes in place, and with the North, South, and Displacement Pond dikes in place.

Simulations were also performed to investigation hydrodynamic conditions at a lower elevation. The elevation of –236 ft msl was selected because the Sea is expected to decline to this elevation (or approximately to this elevation) under all of the alternatives at some time during Phase I operation. Simulations assuming this elevation were performed with shorelines representing No Action, and for various alternative configurations, all with the Displacement Pond dike in place (since the Displacement Dike would likely be present if the elevation declines significantly. The alternative configurations included the Displacement dike alone and in combination with the North Concentration Pond dike, with the South Concentration Pond dike, and with both the North and South Concentration Pond dikes in place.

Figure 4.1-1 shows the direction and magnitude (speed) of the currents near the surface of the Sea with each of the dike configurations at the current elevation of the Sea. The figure portrays conditions at the height of a storm that moved through the area on October 23, 1997. The direction of the arrows shows the direction of the current, but the speed of the current is shown by the length of the arrow. The plot showing conditions under the No Action Alternative is shaded to highlight the distribution of current speeds, with the higher speeds shaded darker. This plot highlights the fact that velocities in the south basin of the Sea tend to be significantly higher than in the north basin. In addition, shading is used on the plots of the alternative configurations to portray the areas in which the speed of the currents would increase or be reduced relative to the No Action Alternative. In this case, darker shading represents a larger change.

Figure 4.1-2 shows information similar to that in Figure 4.1-1, for the same time period, except that the elevation has been reduced to –236 ft msl in order to simulate conditions that would occur if the Sea level decreased due to reduced inflows. All of the configurations include the Displacement Pond dike. The results shown in the figures are discussed further below, relative to each of the alternatives.

Figure 4.1-3 shows the results of simulations of salinity in the Sea for calm conditions that occurred on October 18, 1997. Conditions at two elevations are shown for the No Action Alternative and for a configuration that includes the



r:\new\10138\06\velocity227.cdr - 12/10/99 - GE

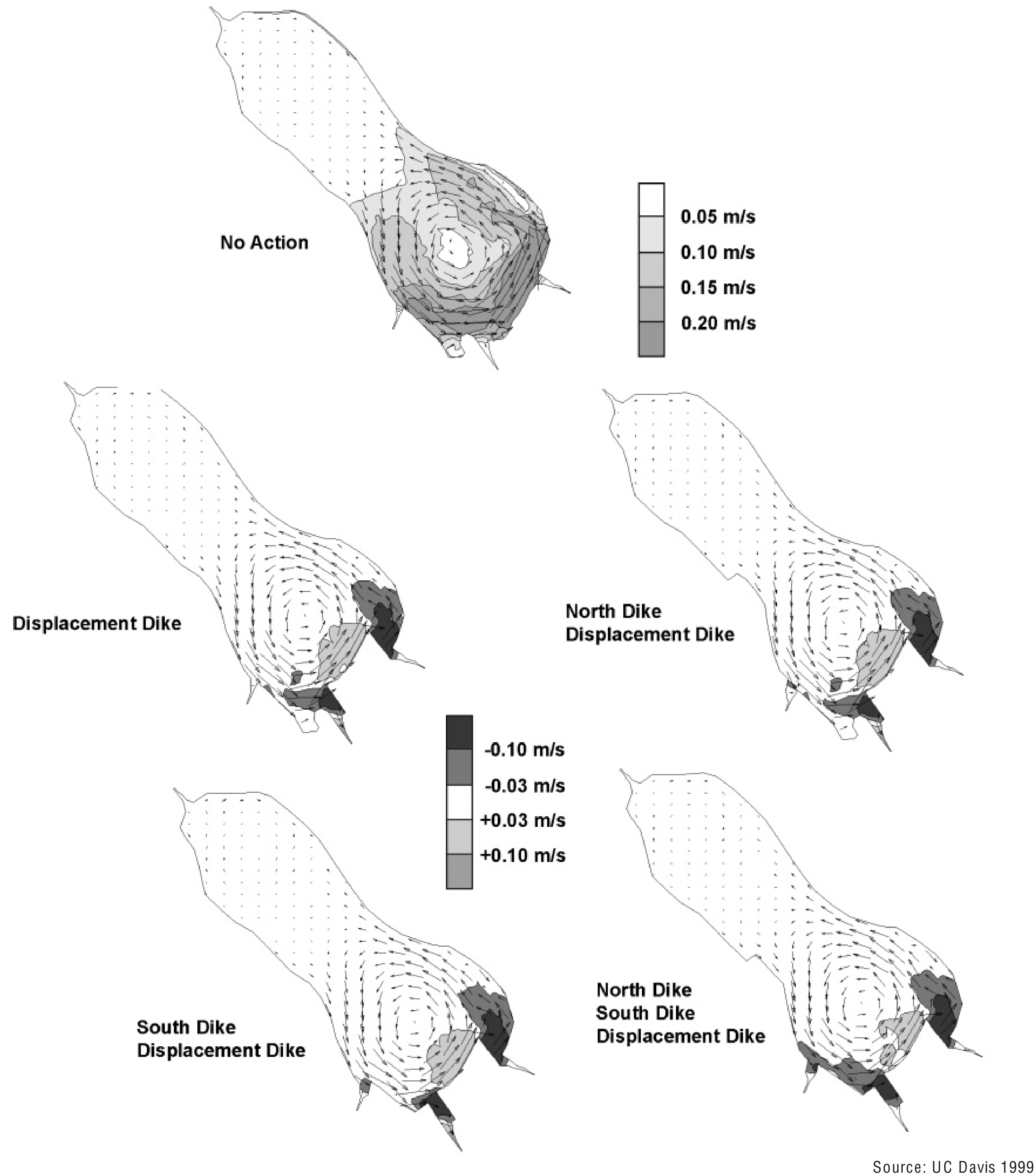
Current velocity simulation generated from meteorologic data for October 8-29, 1997. Conditions shown are for peak wind October 23, 1997.

Comparison of Current Velocity Distributions at -227 feet msl

Salton Sea, California

Tetra Tech, Inc.

Figure 4.1-1



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Source: UC Davis 1999

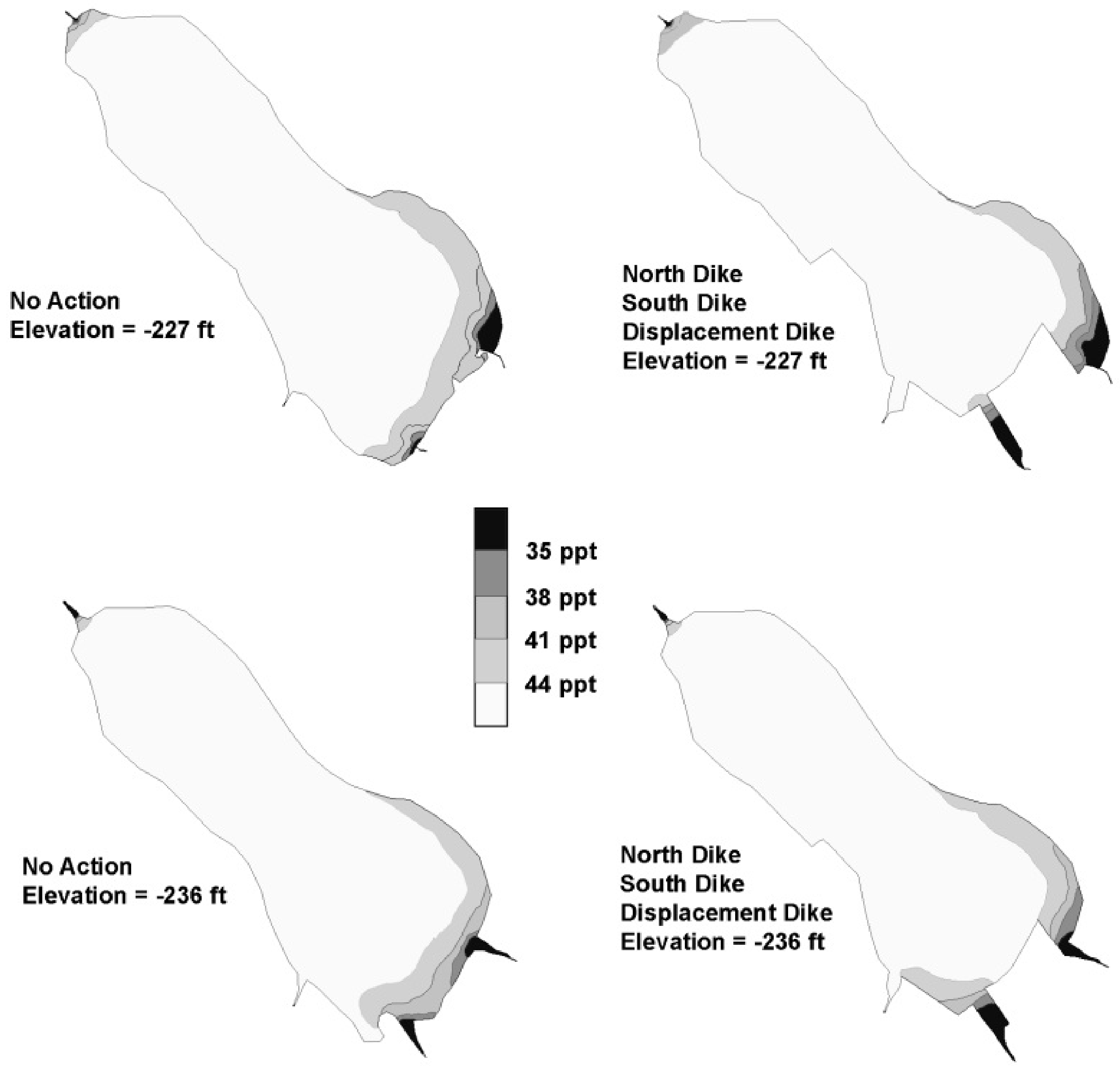
Current velocity simulation generated from meteorologic data for October 8-29, 1997. Conditions shown are for peak wind October 23, 1997.

Comparison of Velocity Distributions at -236 feet msl

Salton Sea, California

Tetra Tech, Inc.

Figure 4.1-2



Source: UC Davis 1999

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Simulations generated by meteorologic data for October 8-29, 1997.

Comparison of Simulated Salinity in Calm Conditions (October 18, 1997)

Salton Sea, California

Tetra Tech, Inc.

Figure 4.1-3

North and South Concentration Pond dikes and the Displacement Pond dike. The dark areas represent fresher water (lower salinity) than the light areas. The plots show the salinity near the surface of the Sea. Results not presented on the plots show that a salt water wedge would form near the mouths of the tributaries, in which fresher water overlies saltier water. Therefore, as a rule, if the plots had shown conditions at a greater depth, the area of transition from fresh to salt water would be narrower at depth.

Figure 4.1-4 shows the same information as Figure 4.1-3, except at the height of the storm event of October 23, 1997, when current speeds were higher.

Figure 4.1-5 shows the effects of differences in wind velocity, elevation, and shoreline configuration on temperature at the surface of the Sea. The plot showing No Action conditions during the storm of October 23, 1997 is presented because it is illustrative of the temperature distribution with lower Sea elevation and with a different shoreline configuration. Based on the results of the simulations, current velocities in the range that occurred in that storm period would produce nearly homogeneous surface temperatures throughout the Sea. The simulations suggest that temperature variations develop during calm conditions, probably mainly due to differences in water depth.

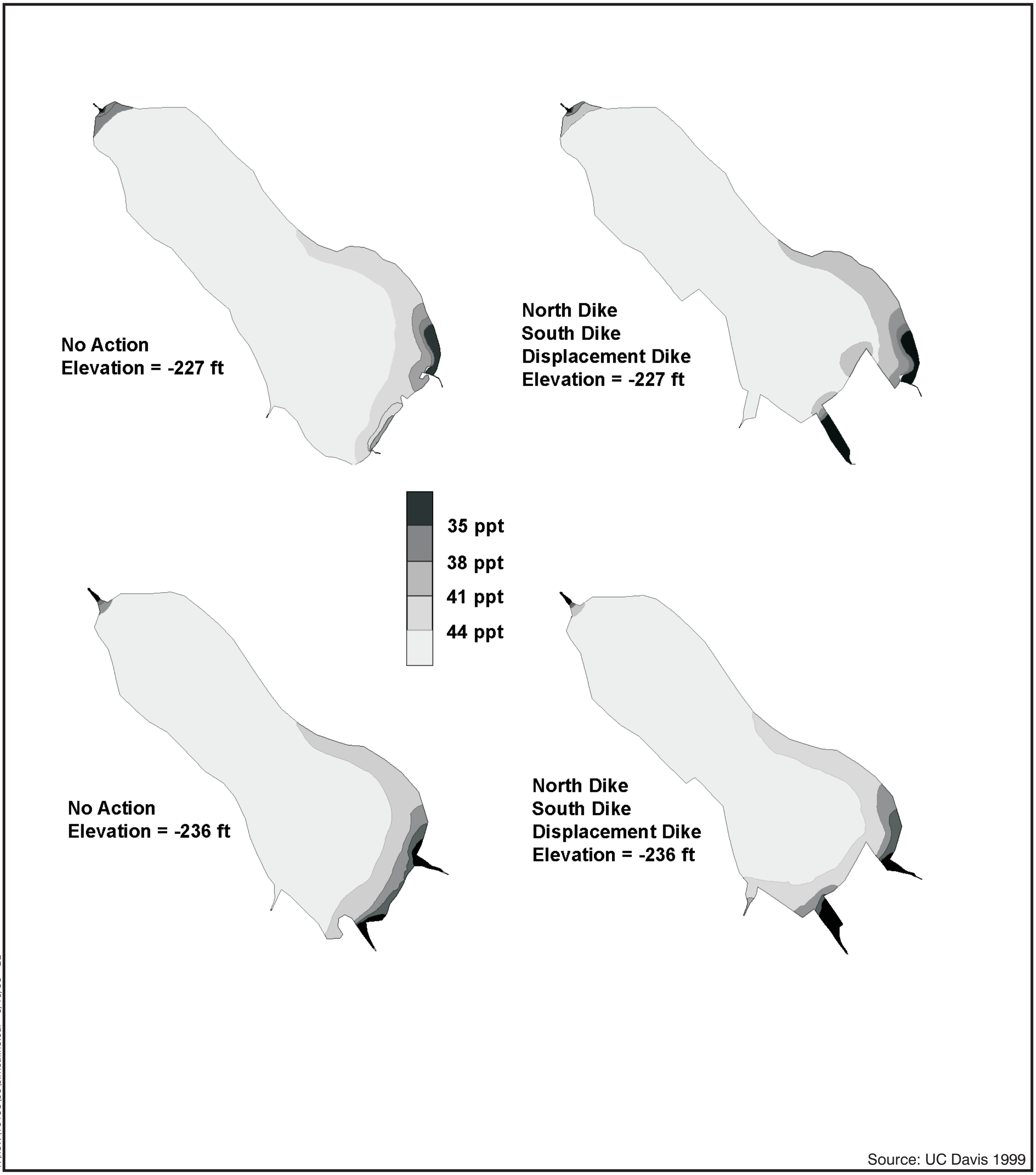
4.1.4 No Action Alternative

Effect of No Action with Continuation of Current Inflow Conditions

Table 2.4-1 summarizes the modeling outcomes for each of the alternatives in the middle of Phase 1 (2015), at the end of Phase 1 in 2030 and in 2060 (30 years into Phase 2). Figures 2.4-1 through 2.4-3 compare the changes in the elevation and salinity of the Salton Sea over time, for average inflow rates of 1.363 maf/yr, 1.060 maf/yr, and 0.8 maf/yr, respectively. Figure 4.1-6 illustrates the range of annual variability of No Action conditions. Figure 4.1-6 shows the upper and lower 95 percent confidence limits and one standard deviation above and below the mean Figure 4.1-6 was prepared using current inflow conditions by stochastically modeling a large number of randomly selected sequences of annual inflows.

Salinity Effects. The model results show that with inflows averaging 1.36 maf/yr, the salinity would increase at a steady average rate of a little less than 400 mg/L/yr. The salinity would be about 53,000 mg/L by 2030. The salinity might range from the mean due to variations in actual annual inflows. Based on the modeling assumptions, the salinity in any year can be expected, with 95 percent confidence, to be within about seven to nine percent of the salinity expected if the average inflow were maintained.

Currently, there are no regulatory criteria for salinity in the Salton Sea. Therefore, the projected increase in salinity does not have any regulatory significance. However, an increase in salinity is likely to have impacts on a



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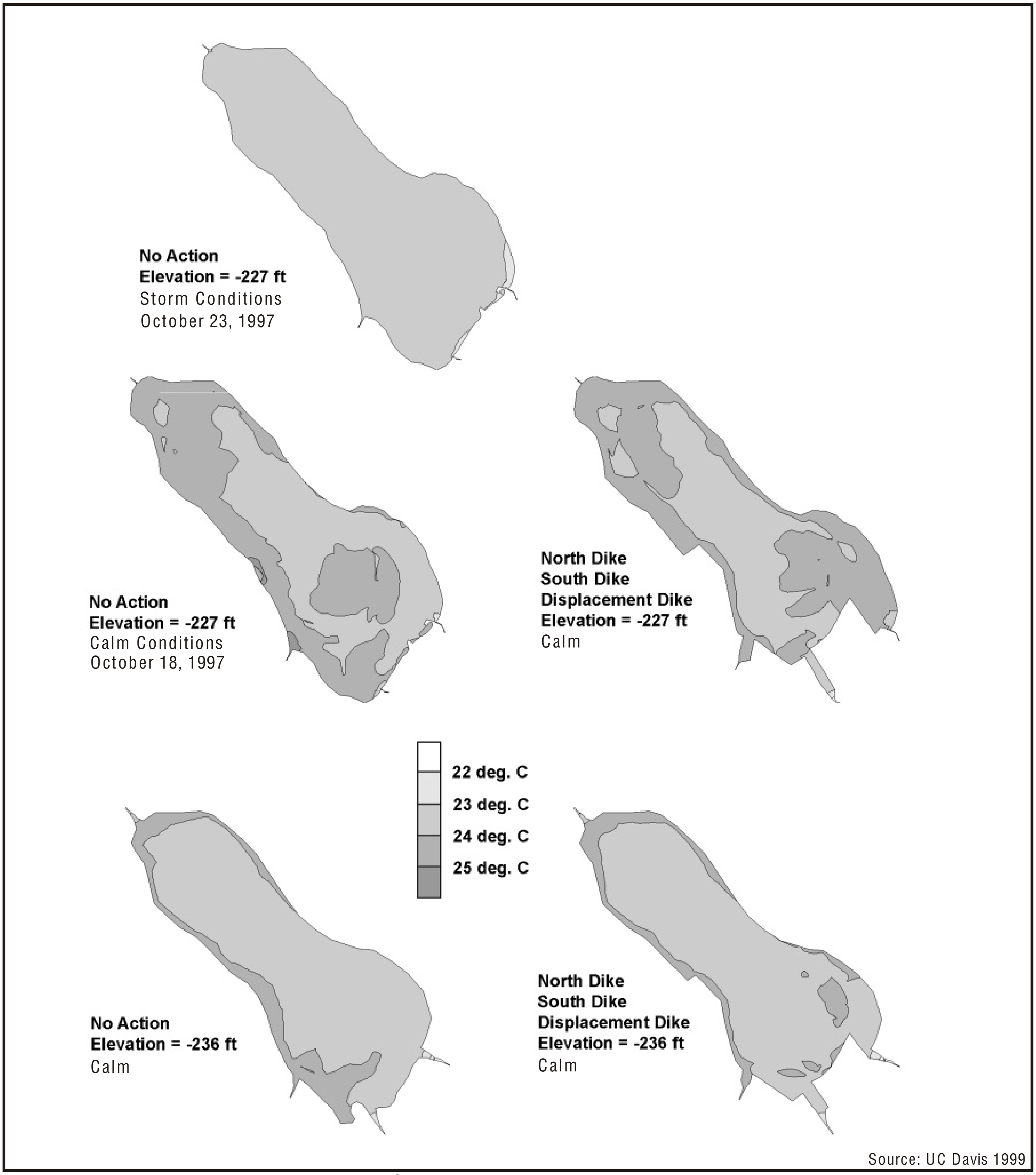
Simulations generated by meteorologic data for October 8-29, 1997.

Comparison of Simulated Salinity in Storm Conditions (October 23, 1997)

Salton Sea, California

Tetra Tech, Inc.

Figure 4.1-4



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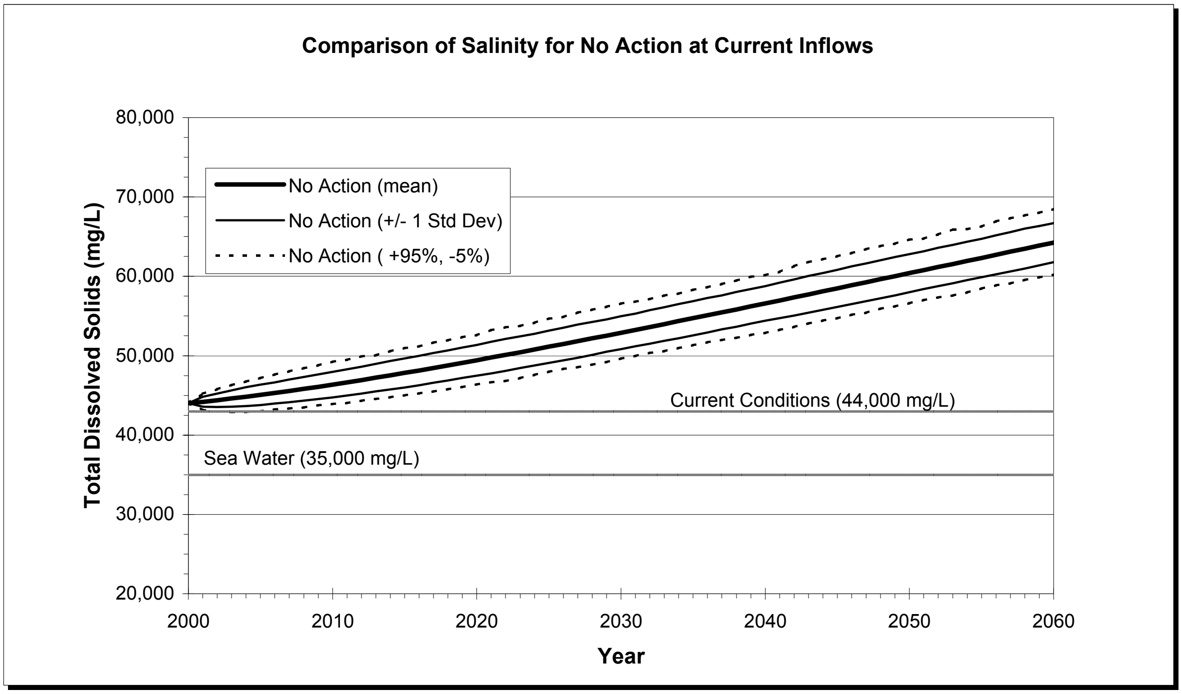
Simulations generated by meteorologic data for October 8-29, 1997. Temperature was nearly homogeneous for storm conditions for all alternatives.

Comparison of Temperature Distribution at Surface of Sea under Storm and Calm Conditions

Salton Sea, California

Tetra Tech, Inc.

Figure 4.1-5



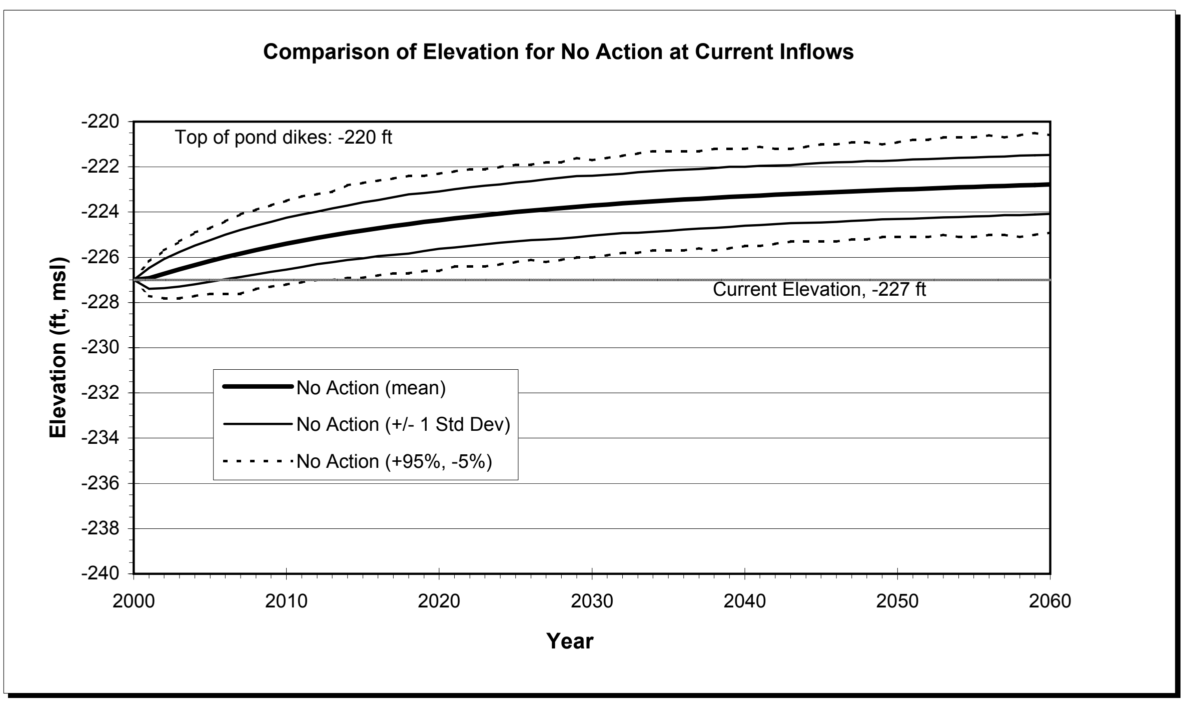


Figure 4.1-6 Range of Variability in Salinity and Elevation due to Variable Annual Inflows, No Action with Current Inflow Scenario (1.36 maf/yr)

number of other resources, including biological, recreational, and socioeconomic. The significance of the salinity increases with respect to these other resources is discussed in subsequent sections.

Elevation Effects. The elevation of the Sea would increase slightly from its current level of –227 ft msl due to the reduced rate of evaporation caused by the salinity increase. Under current inflow conditions, the elevation is expected to rise to about –223 ft msl by 2060.

Circulation Effects. Hydrodynamic conditions in the Sea are not expected to be significantly affected by the increase in salinity or the small increase in elevation. The average density of the water in the Sea would increase, possibly increasing the stability of density stratification in some parts of the Sea where stratification occurs, such as near the mouths of the major tributaries. Based on anecdotal evidence, this stratification effect, which occurs locally in the Sea under current conditions, does not appear to be very stable at current salinities. This is probably because the amount of inflow is small relative to the surface area of the Sea, which causes the fresher surface layer to be thin. Under these conditions, wind and the high evaporation rates at the surface of the Sea promote rapid mixing of freshwater inflows. Density stratification would have the effect of causing circulation patterns in the less dense surface layer to differ from circulation patterns in the underlying layer.

Effects on Colorado River Downstream of Flood Flow Diversion. Under the No Action Alternative, flood flows (flows in excess of the amount of the 1944 Treaty obligation to Mexico that cannot be used or stored within the U.S.), will continue to be released. The quantity of these flood flows is expected to decrease over time as the storage and diversion capacity within the U.S. expands. None of this expanded diversion or storage capacity is expected to affect the Salton Sea. However, baseline flood flow conditions on the lower Colorado River are likely to change.

Effect of No Action with Reduced Inflows

Salinity Effects. Table 2.4-1 and Figure 2.4-2 show the results of simulating No Action conditions, with inflow gradually reduced to 1.06 maf/yr during Phase 1.

The salinity is expected to reach more than 75,000 mg/L by the end of Phase 1. As the salinity increases, carbonate and sulfate salts are likely to precipitate from solution, and the Sea water would become enriched in sodium and potassium chloride salts. This precipitation is not included in the modeling assumptions, but it would have the effect of reducing the salinity compared to the model projections. Chemical and biological precipitation of carbonates and sulfates would probably occur near the mouths of tributaries, where contrasts in water quality are greatest and where new loading to the Sea originates. As indicated above, the increase in salinity would not exceed any existing regulatory thresholds. However, the impacts of increased salinity on other resources would likely be significant and are discussed elsewhere in this chapter.

Elevation Effects. The elevation of the Sea would decrease with reduced inflows. Figure 2.4-2 shows that the elevation would initially drop at a rate of about one-half to three-quarters of a foot/yr. The Sea would reach a minimum elevation of about –234 ft msl at the end of Phase 1.

Circulation Effects. Currently, the maximum depth of the Sea is about 51 ft. The maximum depth of the Sea would be reduced to about 44 ft at the end of Phase 1 and to about 37 ft after another 30 years. The shape of the Sea would be similar to its current shape. However, the depth of the low ridge separating the northern and southern depressions would be reduced to about 28 to 29 ft, compared to its current depth of about 42 to 43 ft.

The results of hydrodynamic modeling of a 9 ft decline in Sea elevation suggests that the overall circulation pattern would be nearly identical to the pattern that exists when the Sea is at –227 ft msl. For both existing and reduced elevations, the model showed that a counterclockwise gyre is produced in the southern basin of the Sea by the prevailing northwest winds, while a less pronounced clockwise rotation occurs in the northeastern portion of the Sea. The highest current velocities would still occur along the southwest shore, south of Salton City. The magnitude of nearshore currents would decrease somewhat relative to existing conditions along the east shore, near Bombay Beach. In general, current velocities tend to be highest in shallow water near the shore. However, with shallower water, more rapid changes in current velocities are expected in certain areas, in response to wind forces.

The model simulations show that the distribution of salinity in the Sea would remain much the same at –236 as at –227 ft. Emergent bottom topography might have a localized effect on salinity. For example, the area of fresher water that exists between the mouth of the Alamo River and Mullet Island when the Sea is at its current elevation would disappear when the Sea level declines to –236 ft.

In addition to the direct effects of circulation, increased velocities may have the effect of transporting dissolved oxygen to greater depths within the water column. However, higher current velocities also could result in greater disturbance of bottom sediments. Bottom sediments are high in organic matter, which uses up oxygen as it decays. Similarly, bottom sediments tend to contain high concentrations of chemically reduced forms of nitrogen (ammonia), phosphorous, iron, and sulfur (hydrogen sulfide), which can combine with and remove dissolved oxygen from the water column. Some substances, including selenium, can become more soluble or biologically available in their oxidized forms. Increased current velocities could increase the turbidity of the water, reducing the depth to which light can penetrate and therefore the effective depth of photosynthesis, which is a source of dissolved oxygen in near-surface waters. Increased current velocities would tend to speed up the transport and distribution of particulates or substances generated within the Sea, including, perhaps, algal toxins. The causes and ecological consequences of algal toxins in the Sea is a subject of current research. Chemical-biological interactions are discussed more fully in the aquatic biology section.

Effects on Colorado River Downstream of Flood Flow Diversion Point. Reduced inflows to the Salton Sea would not affect the amount of excess water delivered to Mexico from the Colorado River. Downstream impacts would be the same as described above for current conditions. Future reduced flood flow deliveries to Mexico resulting from have been factored in to this analysis.

4.1.5 Alternative 1

In this analysis, the Salton Sea is defined as that portion that lies outside the concentration ponds. The ponds perform two restoration functions. They help reduce the salinity of the Sea by removing salts and concentrating them in the ponds. They also displace a portion of the Sea, and thus enable the elevation of the Sea to be maintained closer to the target elevation under reduced inflow conditions.

Two ponds, with a combined surface area of about 34 mi^2, would be created by constructing dikes outward from the shore, beginning at the four points where they intersect the –220-foot topographic contour. The location and configuration of the ponds is shown on Figure 2.4-4, and a typical cross-section of the dikes is shown on Figure 2.4-5.

The dikes would be constructed outward to approximately the –250 ft msl bathymetric contour. The seaward portions of the dikes would be constructed on firm deposits that are estimated to underlie an average of about five feet of soft sediments. The soft sediments would be removed by dredging, and the dredged sediments would be disposed of in the Sea, as construction of the dikes progresses, between sediment curtains designed to reduce the dispersion of suspended sediments in near surface water. The dikes would be constructed outward by dumping quarried material from the ends of the dikes. The tops of the dikes would be 30 ft wide, the maximum height of the dikes would be 35 ft (above the firm sediments at the -250 ft msl contour). The dikes are intended to have a minimum freeboard of five ft. The maximum width at the base of the dikes would be 275 ft (assuming 3.5:1 side slopes). The dikes would cover a bottom area of about 750 acres, requiring dredging and in-Sea disposal of an estimated 6 million yd^3 or more of soft sediments. The maximum water depth along the dikes would be 23 ft.

The ponds would be operated by pumping water from the Sea into the ponds until the elevation inside the ponds reaches –227 ft msl (the current Sea elevation). In practice, as water evaporates from the ponds, more Sea water would be pumped in. But due to the simplifying assumptions of the model, all of the water is assumed to be transferred at the end of each year. The ponds reduce the salinity of the Sea because they remove water containing the average concentration of salts in the Sea, while the inflow to the Sea is at a much lower concentration. The maximum pumping rate to the ponds is determined by the evaporation rate from the ponds. Initially, when the concentration of the Sea is 50,000 mg/L, the evaporation rate from the surface of the ponds would be nearly 121,000 af/yr. However, as the concentration of salts inside the ponds increases, the evaporation rate will decrease. The salt concentration inside the ponds would increase rapidly until it reaches the concentration at which solid salts are precipitated from the saturated brine when the concentration reaches 244,000 mg/L (equivalent to about 200 ppt, or 20 percent by weight). It is assumed that this would occur in about the seventh year of operation. At this time, the rate of evaporation would be about 4.7 ft/yr, instead of 5.8 ft/yr, and the maximum rate of evaporation from the ponds would be 98,000 af/yr.

Effect of Alternative 1 with Continuation of Current Inflow Conditions

North and South Evaporation Ponds

Salinity Effects in the Sea. Modeling results comparing the change in salinity and elevation for three inflow rates are plotted in figures 2.4-1 through 2.4-3. For modeling purposes, the ponds were assumed to begin operating in 2008. The first seven years shown on the graphs are equivalent to the first seven years of the graphs of no action. The plot of the change in salinity with current inflows shows that the salinity of the Sea would be approximately 37,000 mg/L (about the salinity of sea water) by the end of Phase 1 (2030). (It should be noted that the model simulation results are based on the assumption that an accelerated Phase 2 pump-out component would be available by 2015 to prevent the sea elevation from rising too high. This is discussed further below, under Elevation Effects).

The model output provides an estimate of the overall variability in inflows from all causes, which, in turn, would effect the salinity and water surface elevation. This is reflected in the upper and lower 95 percent confidence intervals and the standard deviation from the mean. The one standard deviation confidence interval for salinity for all alternatives is about +/- 3,000 mg/L.

Effects of Salinity in the Ponds. Some of the dissolved elements present in the Sea may be concentrated in the brine rather than precipitating out of solution; a six- or seven-fold concentration could occur. The specific chemical precipitation sequence for the constituents of Salton Sea water have not been quantified. Many of the metals of concern, such as lead, zinc, copper, and cadmium may precipitate from the brine as chlorides. Any compounds that do not form insoluble chemical compounds could become concentrated in the brine, creating a potential toxic hazard to wildlife using the ponds.

Elevation Effects. Preliminary modeling results have shown that the elevation of the Sea would gradually rise to the elevation of the top of the dikes after about 25 years of operation. This rise in elevation would be caused by the difference between the evaporation rate from the ponds and the net annual inflow to the Sea (less evaporation from the surface of the Sea). In order for Alternative 1 to remain viable for the range of potential inflow rates and the rate of decrease in inflow that has been assumed, it is necessary to remove water from the Sea beginning in about 2015. Therefore, subsequent modeling simulations, shown in Figures 2.4-1 through 2.4-3 incorporate the assumption that by the year 2015 excess water would be pumped out of the Salton Sea as needed in order to prevent the increase in elevation of the Sea that would otherwise occur. The export of water from the Sea in 2015 is considered to be an "accelerated"

Phase 2 action, similar to other Phase 2 export actions, but brought on-line earlier. It could be accomplished by pumping water to an enhanced evaporation system (EES) facility on shore, although other options would be considered. The impacts associated with an EES would be similar to those described below under Alternatives 2 and 3. Impacts of other export options are discussed further in Chapter 6. This alternative would require additional NEPA/CEQA analysis before implementation of the accelerated Phase 2 action.

With the elevation control capability made possible by an accelerated Phase 2 export, the model simulations show that by 2030 the elevation would be about –229 ft msl. The ponds are assumed to continue in operation for 30 years, until 2038, by which time, the elevation would reach about –231 ft msl. Thus, as shown in Figure 2.4-1, the elevation would increase from –227 ft to about –224 ft by 2015, and would decline from 2015 to 2038 to about –231 ft.

Water Quality Effects of Construction. The discharge of the dredged material would be subject to the permitting requirements of Section 404 of the Clean Water Act. The proposed discharge would be evaluated by the permitting agency (the US Army Corps of Engineers) and would be subject to review by other agencies, including the RWQCB. Impacts on water quality could result from increased turbidity and resuspension of contaminants entrained in the bottom sediments. Under optimal conditions, the amount of suspended material that would escape from the silt screen is likely to cause only a marginal local increase in the ambient turbidity of Sea water. The dredging project would occur over several years, just ahead of the dike construction. Based on the estimated volume of dredged material, the rate of sediment loading would be approximately 2 million yd^3/yr, or about 0.5 million yd^3, discharged from each of the four ends of the dikes where construction occurs. Assuming that the dry bulk density of fine solids in the sediment is about 0.3 tons/yd^3, then 0.5 million yd^3 of sediment contains about the same quantity of fine solids as entered the Sea via the Alamo River annually in 1996 and 1997. As a rough estimate, the impacts on turbidity in the area of the dredging would probably be roughly comparable to the impacts on turbidity of the inflows from the Alamo River.

Scattered elevated concentrations of some metals, such as copper, cadmium, or selenium, may be present in the bottom sediments in the dredge areas. Recent sampling of sediment cores, performed by Levine-Fricke Recon (1999) as part of the Salton Sea Reconnaissance Studies conducted for the Science Subcommittee, suggest that the average concentrations of most contaminants are relatively low in the southwestern region of the Sea. For example, one core sample contained a selenium concentration of 0.9 mg/kg. Selenium is precipitated at low aqueous concentrations under the reducing conditions found in the deeper waters of the Salton Sea, but aeration of dredged material during handling conceivably could increase the mobility of selenium or other potentially toxic substances contained in it. The effects likely would be temporary, and the selenium or other oxidized substances would be precipitated again in the reducing conditions that predominate at depth.

The more likely effect of the dredged material would be to remove dissolved oxygen from the waters in the dredging area by the reaction of organic material and the reduced forms of minerals in the sediments. The release of hydrogen sulfide from the dredged sediments might result in odor problems and even potentially hazardous conditions for workers. One of the probable conditions of obtaining a Section 404 permit would be a requirement to perform representative sediment sampling and analysis within the proposed dredge area, possibly including a bioassay to evaluate the toxicity of suspended sediments to fish. Although these data are not currently available, compliance with the requirements of a Section 404 permit is expected to ensure that the impacts on water quality are less than significant. If some or all of the sediment cannot be discharged in the Sea, it may either be disposed of on land or discharged in one of the ponds.

Water Quality Effects of Dike Failure During Operation. Dike failure could occur from a number of causes, including settlement or ground shaking along a nearby fault. A failure of one of the dikes, which could be directly caused by strong ground shaking, by liquefaction of dike materials or underlying sediments during a large earthquake, or by displacement if movement occurred along a fault located beneath the dikes, could result in discharge of brine to the Salton Sea. The magnitude of the impact on the Sea of a release of brine would depend on the volume and concentration of the discharge, which in turn would depend on the extent of the failure, the relative height of water in the ponds compared to the Sea, and the amount of time that the dike remains breached until it is repaired. The probability of a large magnitude earthquake in the Salton Sea area is relatively high, but the probability of a dike failure cannot be estimated from existing information. Assuming that a catastrophic breach occurs, the maximum volume of brine in the ponds at any one time, at a concentration of 200,000 mg/L, would be the volume in the seventh year of operation. At this time, the total volume of brine would be nearly 250,000 af, containing a total of nearly 70 million tons of salts. After the seventh year of operation, the salt would begin to precipitate. Solid salt would accumulate on the bottom, and would be less mobile than dissolved salt. While it is not likely that all of the brine in the ponds would be discharged back into the Sea following a breach, the effect of discharge of a large volume of brine into the Sea would be to reverse the beneficial effects of salinity reduction. A release of 70 million tons of salts (the maximum that may be available) from the ponds would result in an increase in the average salinity of the Sea on the order of 5 mg/L from whatever it was at the time. Since the salts would be dispersed gradually, a salinity gradient would be created that decreases from 200,000 mg/L in the vicinity of the breach areas to the ambient concentration of the Sea along the direction of the counterclockwise currents in the Sea. Due to density differences, the hypersaline brine probably would sink initially, and then would gradually mix with the ambient water. Therefore, the effects would propagate over a period of time along the path of the currents in the Sea. While the long-term management would include repairs to the dike, if the breach in the dikes were not repaired, any solid salt in the bottom of the ponds would also gradually dissolve.

Water Quality Effects of Dike Failure After Phase 1 of the Evaporation Ponds. After Phase 1 is complete, about year 2030, if the dikes have not failed, they will continue to contain crystalline salt and possibly a small quantity of brine, due to the solution of salts in the water that enters the ponds from rainfall, runoff, or seepage. Some management is assumed to continue even without implementation of a Phase 2 alternative. Any dike failures at this time would have impacts less than defined above, since most of the salt would be in solid form, and the managing entity would effect repairs to prevent the entire salt deposit from dissolving and re-entering the Sea.

Circulation Effects. Dikes would be constructed near the mouths of the New River and San Felipe Creek, and the dikes would change the configuration of the southwestern shoreline of the Sea. These changes could alter the circulation pattern of the Sea. Hydrodynamic modeling results suggest that the North Concentration Pond dike would have almost no effect on current velocities in the Sea, except for creation of a very localized eddy south of the dike, near the mouth of San Felipe Creek. However, the South Concentration Pond would create a larger eddy to the east of the dike, at the mouth of the New River. The decrease in velocity would probably result in a small increase in the rate of sediment deposition in this area. The presence of the South Concentration Pond dike is also likely to reduce the rate of mixing of tributary flows with the main body of the Sea, resulting in an extended area with salinities below the ambient salinity of the Sea. This effect would be most pronounced under calm wind conditions.

Because of the high biological oxygen demand (BOD) of the inflow from these streams, a reduction in mixing could reduce the already low dissolved oxygen concentration in this portion of the Sea. However, the saturation concentration of dissolved oxygen in fresher water is higher than in saline water, so more oxygen could be dissolved in the freshwater under favorable conditions. In any case, the dikes would create enclaves separated from the general circulation pattern of the Sea, in which different water quality conditions than those in the rest of the Sea would develop.

Mitigation of Circulation Effects. If warranted by the results of more detailed hydrodynamic studies, the dikes should be armored to withstand expected wave action and erosion by currents.

Effects on Colorado River Downstream of Flood Flow Diversion. No flood flows are required under Alternative 1 with current inflow conditions. Therefore, there would be no flood flow impacts.

Pupfish Pond

Water would be pumped into the pond from drains or from the New River. Salinity may be controlled by mixing with water from the Sea. Many of the effects discussed for the larger evaporation ponds would also occur with the Pupfish Pond, but on a smaller scale. For example, minor water quality effects could occur during the installation of the dikes. There would also be some minor circulation effect in the Sea once the pond is installed. These effects are considered minor and not significant.

Water quality in the New River contains a mixture of agricultural wastewater and municipal wastewater discharges, and future water quality could be affected by conservation measures, improvements in wastewater treatment, increased development, and possibly by spills or releases upstream. Drain water contains tile water combined with tailwater, and a decrease in the tailwater component may lead to an increase in the salt concentration. Drain water contains nutrients and farm chemical residues, but is likely to contain relatively low levels of bacteria and suspended sediments compared to the New River.

Since the pond would be shallow, temperatures will fluctuate with ambient air temperature, becoming cold in winter and warm in summer. Reduced oxygen levels in the pond water, growth of algae, sedimentation, and concentration of some contaminants may occur. Due to the length of the pond and the high evaporation rate in the area, the salinity at the lower end of the pond could be significantly higher than the salinity at the upper end. The magnitude of these effects would be dependent on the flow-through velocity. Many of the potential adverse effects, such as over-heating, sedimentation, growth of algae, and concentration of salts could be managed by increasing the flow-through velocity. However, while the upper limit on the flow-through velocity is not known, it would likely be constrained by the needs of pupfish, and possibly by erosion and scouring rates. Mitigation could also include shading of the pond, such as by introducing salt-tolerant vegetation, or allowing natural vegetation to grow.

Runoff from the shoreline during storms may contribute to the flow in the pond for short periods. Some storms may carry enough runoff to exceed the discharge capacity of the pond, resulting in overflows. The flow is likely to occur in the form of discharges from washes. Such flows may temporarily carry significant amounts of sediment into the pond.

As illustrated in Figure 2.4-7, the shoreline protection dikes would be designed so that the elevation of water in the pond would be at about –227 ft. The water would then be three feet deep at the dike, which would approximately follow the –230 elevation contour. The depth would decrease shoreward. Some freeboard would be built in. The dikes could be constructed by about 2008. However, the model simulations for alternative 1 show that from 2008 until 2015, the elevation of the Sea would probably rise as high as –223 ft, or four feet above the desired maximum elevation inside the dikes. The elevation might not return to –227 feet until about 2023. Since the dikes are designed to be open to the Sea at one end, a rise in Sea level would cause a rise in the water level behind the dikes. Therefore, if they were completed in 2008, the dikes might be completely submerged during most of the eight to ten years after they were completed, and would not function as intended for nearly 15 years. In the meantime, they might have some effects on water quality in the near shore area. The presence of the dikes would create a narrow strip of water along the shore that is isolated from the main body of the Sea. There is a potential for this trapped water to become heated, stagnant, and more saline than the water in the adjacent Sea. If isolated from the adjacent Sea, water quality within the dikes might change such that the character of the shoreline habitat would be affected.

As the elevation of the Sea declines below the elevation of the water in the pupfish pond, (after about 2023) some seepage can be expected to occur from the pond to the Sea. The amount of seepage will depend on the difference in water elevation and the permeability of the sediments along the shoreline as well as the permeability of the shoreline protection dike itself. If significant leakage occurs, it would be necessary to increase the inflow to the pond in order to maintain flow through the pond. The result would be a gradual decrease in the velocity of the flow through the pond. The difference between the velocity at the inflow end compared to the velocity at the outflow end could potentially be large, since the pond is long. One result could be that sediment scouring could occur at the upper end of the pond, and sediment deposition could occur at the lower end of the pond.

North Wetland Habitat

The effects of these ponds would be similar to those discussed for the pupfish pond. However, depending on how the flows through the ponds are operated, and the degree to which tributary flows are directed through the ponds, the water quality in the North Wetland Habitat may be significantly different from the water quality in the pupfish pond. With future agricultural conservation measures in response to reduced inflows, the proportion of tail water is likely to decrease, resulting in increased concentrations of agricultural constituents. Among these are selenium, boron, and pesticide and herbicide residues. Thus, water quality in the North Wetland Habitat will likely be dominated by the quality of water in the Whitewater River. As a result, each of the ponds may have different water quality condition.

Figure 4.1-7 Probability Distributions of Future Colorado River Flood Flows Delivered to Mexico

Effect of Alternative 1 with Reduced Inflows

North and South Concentration Ponds

Salinity Effects in the Sea. Modeling results showing the salinity and elevation over time with reduced inflows are shown in Figure 2.4-2 (Chapter 2). The results are shown for the 60-year planning period, but the ponds are assumed to go off-line in 2038. By 2030, with an inflow rate of 1.06 maf/yr, the ponds, in combination with accelerated imports, would continue to hold the salinity at approximately 46,000 mg/L, which is the expected salinity of the Sea when the ponds begin operating in 2008. Reductions in salinity shown in Figure 2.4-2 after 2030 are the result of Phase 2 actions, discussed in the following chapter. With reduced inflows, accelerated Phase 2 pump-out action is needed to control salinity through 2030 and it is assumed to be implemented no sooner than 2015.

Effects of Salinity in the Ponds. The effects of salinity inside the ponds would be the same as described for current conditions.

Elevation Effects. As described above, elevation and salinity control are closely related. The results of reduced inflows to both 1.06 maf/yr and to 0.80 maf/yr are identical. The ponds reduce the volume and surface area of the Sea, but with the assumed rates of reduction in inflow, the elevation would drop below the target level of –232 ft by about 2025. By the end of Phase 1, in 2030, the elevation would be about –237 ft msl. In both of the reduced inflow scenarios, the level of the Sea would be well below the elevation of the brine in the ponds (-227 ft msl). The difference in head would increase the potential for leakage and erosion of the dikes under normal operating conditions, and would allow the brine in the ponds to drain to the elevation of the Sea in the event of a catastrophic failure of the dikes.

Circulation Effects. To the extent that they help to maintain the elevation relative to No Action at the corresponding inflows, the ponds would have a beneficial effect on circulation.

Effects of Dike Failure. As discussed for the current inflow scenario, any failure of the dikes caused by ground shaking or from other causes might result in rapid evacuation of the brine contained in the dikes if the elevation of the water in the ponds were above the elevation in the Sea.

Displacement Dike

The displacement dike would effectively reduce the surface area of the Sea. The effects of constructing the dike would be similar to the effects of constructing the dikes for the evaporation ponds discussed previously. There would be some changes to the circulation patterns in the south end of the Sea. The impacts of these changes have not been quantified through hydrodynamic modeling, but are not expected to be significant, with the exception of the creation of a deep indentation in the shoreline where the New River enters the Sea between the displacement dike and the Southwest Pond, and a potential eddy area on the east side of the displacement dike, where the Alamo River enters the Sea. Water quality conditions in these indented areas are likely to be different from conditions in the Sea. Salinity would likely be lower in these areas, because they will be dominated by the fresh water inflows from the tributaries. One of the effects might be to create a broader range of conditions and potential habitats for fish and other species. In essence, the effect is to lengthen the outlets of the tributaries and to increase the transition zone between the tributaries and the Sea. On the other hand, current velocities may be lower, and may be reversed in portions of these indented shoreline areas, which may lead to increased rates of sediment deposition in these areas.

The areas behind the dikes (on the shoreward side) could alternately be dry or contain standing water, depending on the time of year and the meteorological conditions. It is likely that any standing water would be highly saline and of generally poor quality.

4.1.6 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

Modeling results for continuation of current inflow conditions for Alternative 2, in comparison to other alternatives, can be found in Figure 2.4-1.

<u>EES Located North of Bombay Beach (150 kaf/yr showerline technology)</u>

Salinity Effects in the Sea. Modeling results show that following construction of the EES, salinity would continue to gradually rise to a maximum of about 47,000 mg/L in the middle of Phase 1, and then decrease to about 45,500 mg/L at the end of Phase 1. The salinity would continue to decline if the EES system continued to be operated in the same way beyond 2030.

Elevation Effects. The elevation of the Sea would decline gradually from an elevation of about –226 ft at the start of operation to about –232 ft msl at the end of Phase 1. Although salinity could continue to be decreased after 2030 through continued operation of the EES, the elevation would decline. Therefore, importation of CASI water is included in Phase 2 so that both salinity and elevation can be controlled together. Comparison of the effects of continuing the Phase 1 action without additional Phase 2 action to the effects of implementing the Phase 2 alternatives is discussed in Chapter 6.

Circulation Effects. The effect of the EES on circulation patterns would be minimal, because the alternative would prevent the elevation from declining further than -232 ft level during Phase 1. Preliminary modeling results suggest that the circulation pattern of the Sea would be almost identical to the current pattern above an elevation of –240 ft, although small changes in current velocity might occur.

Effects on Colorado River Downstream of Flood Flow Diversion. No flood flows would be required in Alternative 2 with current levels of inflow, and therefore, no impacts would occur.

Effect of Alternative 2 with Reduced Inflows

Import Flood Flows

The modeling results for the reduced inflow scenarios shown in Figure 2.4-2 reflect the result of adding flood flows in 2015 for the reduced inflow scenario. The projected availability of these flood flows is based on probability distributions. Since flood flows are not available every year, the effects would be exaggerated in those years when the flood flows are available. If the maximum flood flow diversion of 300,000 af were imported over four months, the rate of delivery to the Sea would be about 1,250 cfs. At its current elevation, 300,000 af is approximately enough to raise the elevation of the Sea 1.7 ft. The increase in elevation would be greater if the Sea were initially at a lower elevation.

The imported flood flows would be discharged via existing channels, including the Alamo River, Salt Creek, and Evacuation Channel No. 1 at the north end of the Sea. The discharge to the Alamo River might exceed the existing channel capacity in some portions of the upper reach, and would likely cause scouring of the channel in others. No information was available at the time of writing to assess these potential impacts in detail. If flows were too high for the existing channel capacity, this would represent a significant impact.

During high flows in the Colorado River, the silt load is higher than normal. Diversion of this silt-laden water will increase the load on desilting works at Imperial Dam and on concrete-lined conveyance facilities.

Existing flows in Salt Creek are quite low, and are fed primarily by seepage from unlined portions of the Coachella Canal. Depending upon the amount of the discharge, a prolonged discharge of flood flows into Salt Creek for a period of four months is likely to significantly change the rate of flow and the water quality in the creek. Higher flows could result in channel scour and increased turbidity. The water could become cooler and would have lower dissolved solids concentrations than under No Action conditions.

Salinity Effects in the Sea. Comparison of Figure 2.4-2 with Figure 2.4-1 shows that with reduced inflows, it becomes increasingly difficult to control both salinity and elevation. The modeling results show that neither the salinity target nor the elevation target is achievable with reduced inflows. For 1.06 maf/yr of inflow, the modeled salinity increases from the initial 50,500 mg/L at the start of operation, to a peak of about 62,500 mg/L in 2030, after 17 years of operation. Without the import of water in Phase 2, the salinity would continue to increase and the elevation to decrease, after 2030.

Elevation Effects. For reduced inflows, the elevation and salinity cannot be managed to achieve the target levels of both. The modeling results in Figure 2.4-2 show that the salinity target could be achieved at the expense of elevation control, but the inverse is also possible (elevation could be controlled at the expense of salinity). The results shown in the figure illustrate the tradeoff, but this solution is not unique; many other combinations of salinity and elevation would be possible. The results show that the elevation would fall to about –237 ft msl at the end of Phase 1 with reduced inflow.

Circulation Effects. The effects on circulation of Sea water when the elevation is -237 ft would be similar to those discussed for the No Action Alternative for –236 ft. The decline in elevation would ultimately be less under Alternative 2 than for the No Action Alternative because of the importation of flood flows.

Effects on Colorado River Downstream of Flood Flow Diversion. Up to 300,000 AFY of flood flows would be diverted to the All American Canal at Imperial Dam when available, if needed to maintain the elevation of the Sea due to reductions in existing sources of inflow. The availability of flood flows, and the potential effects the flood flow diversion, have been evaluated based on assumptions about the probable size and timing of the flows.

Figure 4.1-7 shows the maximum flood flow diversion of 300,000 AFY, superimposed on the probability distribution curves for future flood flow deliveries to Mexico. (The probability distributions described in this analysis were introduced in Chapter 3). The line representing 300,000 AFY crosses the lower part of the probability curves. For example, it crosses the curve of the probability distribution of flood flows in 2010 at a point representing a probability of a little less than 22 percent.

The graph shows that the diversion of 300,000 AFY would consume all of the available flood flows that otherwise would have been delivered to Mexico in less than two percent of all years.

To put this into perspective, it should be remembered that under the No Action Alternative, no flood flows are likely to be delivered to Mexico in about 73 percent of the years under 2010 conditions (and about 68 percent of years in 2030 conditions). Thus, the flood flow diversion to the Salton Sea would result in a small increase in the likelihood that no flood flows would be delivered to Mexico.

As the size of the flood flows increases, the effect of a reduction of 300,000 AF is expected to lessen, because the diversion would be a smaller proportion of the flood flows that actually do reach Mexico. A flood flow reduction of 300,000 represents a reduction of only 10 percent relative to a flood flow of 3 MAFY, for example. Under 2010 No Action conditions, flood flows of 3 MAFY occur in about 10 percent of all years, and under 2040 No Action conditions this size of flood flow is expected to occur in less than 6 percent of all years. If a reduction in the magnitude of flood flows to Mexico of greater than 10 percent is taken as an indication of a potentially significant reduction, then the diversion of 300,000 AFY of flood flows to the Salton Sea would cause this level of flow reduction, in an additional 13 percent of the years relative to 2010 No Action conditions, and in and additional 11 percent of the years relative to 2040 No Action conditions.

The discussion in Chapter 3 indicated that in 14 of the past 49 years, about 10 percent of the available flood flows delivered to Mexico were diverted for irrigation, and the remaining flows were released in the Colorado River. The average amount of flood flows diverted to irrigation was about 500,000 AFY. By diverting less of the future flood flows to agricultural uses, existing levels of flow to the lower Colorado River Delta could be maintained. However, if historical levels of agricultural diversions of flood flows were to continue, then reductions in flood flows would result in a reduction in Colorado River flows. Based on the discussion in Chapter 3, one of the potential impacts would be to reduce flows to the Rio Hardy wetlands.

Another measure of comparison of the hydrologic impact of flood flows is on the rate of evaporation of the volume of the flood flow diversion. Assume that evapotranspiration rates in the Colorado Delta are about the same as in the Salton Sea (about 5.8 feet per year). Further assume that the 300,000 AFY of flood flows diverted to the Salton Sea would directly reduce the volume available to support the Rio Hardy wetlands. Based on these assumptions, 300,000 acre-feet is enough to keep about 25,000 acres of the Rio Hardy wetland moist for a period of about two years. This is about the size of the wetland in 1992, when about 3 MAF of the flood flows received by Mexico were released to the Colorado River from Morelos Dam.

It should be noted that under the existing treaty with Mexico, the U.S. has no obligation to deliver flood flows in any year, and that the diversion of flood flows to benefit the Salton Sea would occur only after all treaty obligations were fulfilled.

4.1.7 Alternative 3

Alternative 3 does not differ substantially from Alternative 2 with respect to its impacts on surface water resources. The only differences between the alternatives is the location of the EES system on land and the location of the intake in the Sea. Therefore, the surface water impacts are expected to be identical to those described under Alternative 2.

4.1.8 Alternative 4

The combination of an EES and a concentration pond provides flexibility to control both the salinity and the elevation. The EES enables water to be pumped out of the Sea when inflows are at current levels. Therefore, it removes the excess inflow that would cause the elevation of the Sea to rise if only an evaporation pond is installed. Additionally, with reduced inflows, the ponds reduce the size of the Sea, which helps to maintain the elevation when water is removed to control salinity. Alternative 4 addresses the problems of balancing the competing goals of maintaining both elevation and salinity, because if the elevation declines, the amount of water pumped into the ponds can be reduced, while the EES component can continue to be operated to control the salinity. Nevertheless, with decreased inflows, the elevation would decline. Therefore, a displacement dike is needed in order to maintain the elevation.

Effect of Alternative 4 with Continuation of Current Inflow Conditions

South Evaporation Pond and an EES Located at the Salton Sea Test Base (100 kaf/yr showerline technology)

Salinity Effects in the Sea. The salinity would level off and then begin to gradually decline several years after the ponds and EES are completed. Both would be operated initially at their maximum pump-out rates in order to achieve the maximum reduction in salinity as soon as possible, after which, the rate of pump-out could be reduced to help manage elevation. The model simulation shows that salinity would be reduced to about 39,500 mg/L by the end of Phase 1.

Effects of Salinity in the Ponds. The effects of salinity within the ponds would be identical to the effects described for Alternative 1. However, since the elevation would remain relatively high (compared to Alternatives 2 and 3), the head difference between the Sea and the water in the ponds would be small throughout Phase 1. The smaller the head difference, the less likely that a catastrophic failure of the pond dikes would cause all of the brine in the ponds to enter the Sea before repairs could be made.

Elevation Effects. There would be an initial increase in elevation of about one foot, to about –225 ft, and then the elevation would begin to decline, reaching a little less than –229 feet by 2030.

Circulation Effects. The circulation impacts of Alternative 4 would be due primarily to the configuration of the pond dikes rather than to a change in elevation, because the elevation of the Sea would be maintained above about –229 ft.

As can be seen in Figure 4.1-1, the South Concentration Pond would have the effect of creating an area of reduced currents (eddy) east of the South Concentration Pond dike, out from the New River. Salinity in this area would probably remain lower than in the main body of the Sea, especially during calm wind periods, due to reduced mixing of tributary inflows.

Effects on Colorado River Downstream of Flood Flow Diversion. With current inflows, no supplemental flows would be required. Therefore, there would be no flood flow-related impacts.

Pupfish Pond

The effects of this pond would be the same as under Alternative 1.

North Wetland Habitat

The effects of this pond would be the same as under Alternative 1.

Effect of Alternative 4 with Reduced Inflows

South Evaporation Pond and an EES Located at the Salton Sea Test Base (100 kaf/yr showerline technology)

Salinity Effects in the Sea. With reduced inflows the control of salinity requires a greater reduction in the Sea elevation than for current inflows. The modeling simulations show that the salinity would remain fairly constant throughout Phase 1 and that by the end of Phase 1 the salinity would be about 47,000 mg/L.

Effects of Salinity in the Pond. The change of salinity in the pond and its impacts would be identical to those described for Alternative 1 for reduced inflows, except that the elevation of the Sea would stand lower than the elevation of the brine in the ponds for more of the time.

Elevation Effects. The model simulations indicate that Alternative 4 would be more effective in controlling elevation at the end of Phase 1 than any of the other alternatives. However, with reduced inflows the elevation is still projected to decline to –235 ft msl for this alternative. The projected change in elevation is comparable to the projected change in elevation with the No Action alternative.

Circulation Effects. As illustrated in Figure 4.1-2, at an elevation of about –236 ft the eddy areas would be created east of the Displacement dike and between the South Concentration Pond and the Displacement dike, out from the mouths of the Alamo and New Rivers. Currents would tend to increase along the north wall of the Displacement dike. In eddy areas at the mouths of the tributaries, salinity would remain below the levels in the main body of the Sea, however, the change in salinity relative to the No Action alternative would be minor at low elevations.

Effects on Colorado River Downstream of Flood Flow Diversion. The effects of a diversion of flood flows would be the same as those discussed for Alternative 2.

Displacement Dike

The effects of the displacement dike would be the same as those discussed for Alternative 1.

Import Flood Flows

The effects of importing flood flows would be the same as those discussed for Alternative 2.

4.1.9 Alternative 5

The combination of an evaporation pond with an In-Sea EES and the ponds provides flexibility to control both the salinity and the elevation. The EES enables water to be pumped out of the Sea when inflows are at current levels. Therefore, it removes the excess inflow that would cause the elevation of the Sea to rise if only an evaporation pond is installed. However, with reduced inflows, the pond would reduce the size of the Sea, which would help maintain the elevation when water is removed to control salinity.

The pond would have a design life of about 23 years; therefore, an additional export mechanism would be needed after Phase 1.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Northwest Evaporation Pond and an In-Sea EES (150 kaf/yr spray technology)

Salinity Effects in the Sea. The salinity would begin to gradually decline soon after the ponds and EES are completed. Both would be operated initially at their maximum pump-out rates in order to achieve the maximum reduction in salinity as soon as possible. There would be an initial reduction in elevation to the target elevation, but as the salinity is controlled, the pump-out rate would be reduced. The model simulation shows that salinity would be reduced to about 41,000 mg/L by the end of Phase 1. As an illustration of the greater flexibility available to manage the tradeoffs between salinity and elevation control, Figure 2.4-1 shows that if elevation is managed identically to Alternatives 2 and 3, Alternative controls salinity better than Alternatives 2 and 3.

Effects of Salinity in the Ponds. The effects of salinity within the ponds would be identical to the effects described for Alternative 1.

Elevation Effects. The elevation of the Sea would decline gradually after the start of operation to about –232 ft msl at the end of Phase 1.

Circulation Effects. As can be seen in Figure 4.1-1, the North Concentration Pond would have almost no impact on velocities in the Sea, except for a very small decrease near the mouth of San Felipe Creek. Similarly, the distribution of salinity would remain nearly identical to that under the No Action Alternative. Because of the steep drop to deeper water east of the dike, water temperatures in this area would probably tend to decrease in this area, and this might reduce the temperature down-current of the dike somewhat. These effects are not expected to be significant.

Effects on Colorado River Downstream of Flood Flow Diversion. Since flood flows would not be imported under current inflow conditions, no impacts would occur.

North Wetland Habitat

The effects of this pond would be similar to those discussed for this alternative under Alternative 1, existing inflow conditions.

Effect of Alternative 5 with Reduced Inflows

Northwest Evaporation Pond and an In-Sea EES (150 kaf/yr spray technology)

Salinity Effects in the Sea. With reduced inflows of 1.06 maf/yr, the control of salinity results in a greater reduction in the Sea elevation than for current inflows. The modeling simulations show that the salinity would increase slightly, to about 48,000 mg/L during the first five or six years after construction. Salinity would then decline gradually, until by the end of Phase 1 the salinity would be about 46,000 mg/L.

Effects of Salinity in the Pond. The change of salinity in the pond and its impacts would be identical to those described for Alternative 1.

Elevation Effects. The model simulations indicate that Alternative 5 would be less effective than Alternative 4 in controlling elevation throughout Phase 1. The elevation is projected to drop below the target elevation about ten years after construction is competed, in 2018, and the elevation would continue to decline until it reached approximately –236 ft msl in 2030. However, as mentioned for other alternatives, there are tradeoffs between elevation control and salinity control, and within the range of uncertainty in the assumptions of the model, alternatives pond alternatives perform similarly.

Circulation Effects. Circulation effects would be similar to those described above for this alternative with current inflows. The elevation is not expected to decrease sufficiently to result in significant circulation impacts due to elevation alone.

The addition of the Displacement Pond dike would create an eddy east of the dike, outward from the mouth of the Alamo River, and would probably create an eddy on the west side, out from the mouth of the New River. In these areas, current velocities would be slower than they would be without the dikes. Reduced mixing would occur in these areas, and the salinity would remain lower than in the main body of the Sea because of the slower dispersion of tributary flows. More sediment would be deposited in these areas. Slightly increased temperatures might occur offshore from the east end of the Displacement dike during calm wind periods.

Effects on Colorado River Downstream of Flood Flow Diversion. The impacts downstream of the diversion of flood flows would be the same as described for Alternative 2.

Displacement Dike

The effects of the displacement dike would be similar to those discussed for this alternative under existing inflow conditions.

Import Flood Flows

The effects of importing flood flows would be the same as those discussed for Alternative 2.

4.1.10 Cumulative Effects

As discussed in Chapter 2 of this EIS/EIR, a number of regional projects could have long-term effects on the average annual inflow to the Sea. Likewise, a number of other processes could have long-term effects on the future inflows, including changes to agriculture practices, competing demands for water, and natural climatic adjustments. The most likely results of these processes is that future inflows to the Sea could be lower than current conditions, and the concentration of dissolved and particulate matter in the inflow would be increased. These cumulative impacts on the volumes and quality of inflow have been captured within the assumptions of the reduced inflow scenarios.

4.1.11 Mitigation Measures

Mitigation of Dike Failure Impacts. While a dike failure caused by a large earthquake cannot be prevented, it might be possible, depending on the size of the failure and the elevation of the brine relative to the elevation of the Sea at the time of the failure, to repair the dikes in time to prevent release or mixing of the Sea with all of the brine inside the ponds. Therefore, rapid assessment of the extent of the problem and the speed with which the dikes are stabilized may mitigate much of the damage to the Sea that could occur. Compartmentalizing the ponds could increase the likelihood that at least a portion of the brine would be contained if a breach occurred in one part of the dike system. Similarly, a compartmented pond system could be operated in such a way as to segregate more concentrated brine or to crystallize the salts in less vulnerable portions of the pond system. Continuous removal of brine from the ponds, and disposal and crystallization on land could reduce the volume of salt having the potential for release to the Sea, and it could help to maximize the evaporation rate from the ponds. The cost of any engineering measures that would reduce the potential for a failure, or the potential effects of a failure, would likely be very high, and must be weighed against the risks of a breach. An alternative type of mitigation measure has been built into the common actions in the form of the shoreline habitat protection ponds. These ponds would have the potential benefit of allowing a small portion of the Sea to survive even if the Sea itself collapses. However, the shoreline ponds themselves are not necessarily invulnerable to failure from various causes, and would not fully compensate for loss of the Sea.

Mitigation for Potential Impacts on Colorado Delta from Diversion of Flood Flows. It is not clear whether significant impacts might occur in the Colorado River Delta at some level of flow. If such impacts were found to be significant, mitigation could include making diversion of flood flows to the Salton Sea contingent on the delivery of additional water for specific purposes within the Delta. Such a contingency would need to be formalized by amendment to the 1944 Treaty, and in order to be effective, would probably require assurances that the water would be diverted to the intended uses (such as maintaining the Rio Hardy wetlands).

4.1.12 Potentially Significant Unavoidable Impacts

Release of brine to the Sea and the consequences of such a release on the water quality of the Sea is a potentially significant and unavoidable impact of failure of the concentration pond dikes in alternatives 1, 4, and 5. The potential for failure of the dikes is unknown.

4.2 GROUND WATER RESOURCES

4.2.1 Summary of Environmental Consequences

The main effect of the alternatives is to change the base level of the regional aquifer, which is controlled by the elevation of the Salton Sea. The Salton Sea has a minor effect on perched aquifers in Imperial County, so changes in the Sea level would not be expected to have any impact on perched ground water there. In the Coachella Valley, where the regional aquifer is near the ground surface and can already contribute to drainage problems, a decrease in the elevation of the Sea could lower the regional water table and reduce the drainage problems. The elevation of the Sea is expected to decline under the No Action Alternative with reduced inflow conditions. None of the alternatives would affect artesian groundwater systems in the basin.

For Alternative 1, Sea elevation would rise with current inflow conditions. While the rise in Sea level could be prevented by breaching the dikes of the concentration ponds, an increase in the elevation of the Sea might contribute to drainage problems in low-lying areas of the Coachella Valley bordering the Sea. Similarly, increases in salinity of the Sea could increase the potential for saline water intrusion, if ground water is pumped upgradient of the Sea. The effects of saline water intrusion are increased in proportion to the difference in density between freshwater and salt water. These effects are likely to be most significant in Coachella Valley and not very significant in Imperial Valley, where there is little recharge to the regional aquifer, and most of the recharge is to the perched aquifer. The perched aquifer is not affected by conditions in the Sea.

Seepage from the brine collection ponds of the EES system sited at the former Salton Sea Test Base could result in a significant increase in the salinity of flows in San Felipe Creek.

Importation of flood flows from the Colorado River may have significant local effects on ground water conditions adjacent to streams used to convey the water to the Sea. For example, the upper reach of the Alamo River would receive significantly more flow than it normally does, and this is an area in which some of the stream flow recharges the regional aquifer. The recharge might result in a local beneficial impact because it would increase the quantity of ground water stored in the aquifer. Seepage from the stream channel would reduce the quantity of the flood flows that reach the Sea.

4.2.2 Significance Criteria

Impacts on ground water resources include changes in ground water quality, changes in the quantity of ground water available for existing or potential beneficial uses, and changes in the depth to ground water or in the magnitude or direction of the hydraulic gradient. Adverse impacts are judged to be significant if they do not comply with regulatory standards, plans, or policies; otherwise, the significance is based on the degree of harm the impacts may cause to humans or the environment. In general, any degradation of water quality that may reduce the existing or potential beneficial uses of the water is considered significant. The significance of a reduction in the quantity of ground water available for beneficial uses depends on the size, timing, duration, and permanence of the effect. The significance of changes in hydraulic conditions, such as direction of flow, depends on the context in which the change occurs.

4.2.3 Assessment Methods

Potential impacts of project alternatives on ground water were assessed through review of available literature and discussion with experts to build a conceptual model of the ground water conditions in the study area (as described in Chapter 3) and the use of professional judgment to identify the ways in which project components would interact with the ground water system. Although the creation of a ground water flow model was not deemed appropriate for this assessment, others have performed modeling of portions of the study area, and their results were considered in this assessment. The ground water contribution to the inflow to the Salton Sea is believed to be relatively minor compared to the contribution of surface water. Also, because the Sea is a terminal lake, most of the ground water system lies upgradient of the proposed project actions. Thus, the focus of the assessment was on those components of the project that would be located within the region upgradient of the Sea, that are outside the hydrologic basin of the Sea, or that could indirectly affect ground water flow patterns. For example, increased surface water flows in ground water recharge areas can result in increased ground water recharge. Also, lowering the elevation of the Sea could lower the base level of the regional ground water system, resulting in a readjustment of the regional gradient and increased depth to ground water upgradient of the Sea. In general, the assessment of impacts on ground water resources is a qualitative assessment because most of the impacts are expected to be minor and do not warrant more detailed analysis.

4.2.4 No Action Alternative

Effect of No Action Alternative with Continuation of Current Inflow Conditions

No ground water impacts are expected with continuation of current inflows. Actually, a large portion of the current inflows are derived from ground water that has been collected in subsurface drains from the perched aquifer in the Imperial Valley, and from shallow ground water intercepted by subsurface drains in the Coachella Valley. Therefore, a continuation of existing inflows implies that there would be no change in the perched ground water system.

Effects of No Action Alternative with Reduced Inflows

Reduction in inflows are expected to occur as a result of reductions in the quantity of agricultural tailwater, improved irrigation efficiency, changes in cropping patterns, and other conservation measures. Most of the reductions would occur at points that do not affect the amount of ground water recharge or ground water use. For example, because very little of the applied irrigation water percolates below the perched water table in the Imperial Valley, a reduction in the amount of water applied would not necessarily change the amount of recharge to the regional aquifer.

It is possible that reductions in the amount of surface water imported to the region could lead to a shift to greater ground water use for irrigation. Ground water currently is used very little, and the ground water quality is relatively poor compared to imported surface water. An increase in ground water use could have significant impacts on ground water quality if it were to reduce the elevation of the regional water table. A reduction in the regional water table could lead to saline water intrusion from the Salton Sea. Under the No Action Alternative, the salinity of the Sea would continue to increase. The effects of saline water intrusion would be enhanced by increased salinity in the Sea.

4.2.5 Alternative 1

Effect of Alternative 1 with Continuation of Current Inflow Conditions

The construction of concentration ponds in the Sea would maintain the Sea at a higher elevation than under the No Action Alternative for a given inflow. At current inflows, the elevation of the Sea would rise to an elevation of –224 ft msl by about 2015, when accelerated Phase 2 exports are initiated. The increased elevation would increase the base level of the regional aquifer. If the base level rises, the elevation of the regional water table will rise also. The amount of the rise would be relatively minor, but there could be significant local effects, such as in the southern part of Coachella Valley. If the regional water table rises, it could increase drainage problems in low-lying lands.

Pumping ground water to offset the rise would increase the potential for saline water intrusion, which is caused by the difference in density between saline water and freshwater. Freshwater is less dense and floats on saline water. The freshwater layer "piles up" over the salt water. Pumping the fresh water reduces the weight of the freshwater above the salt water and allows the salt water to flow toward the region of lower pressure. A small reduction in the elevation of the freshwater surface can allow a large rise in the salt water surface. For saline water at about 35 mg/L, a reduction in freshwater head can cause the salt water interface to rise about 40 ft, under hydrostatic conditions. While the relationship between salt water intrusion and changes in fresh water head are far more complex in most situations, the general effect is that lowering the freshwater head, by pumping wells near the Sea, for example, could induce salt water to enter the aquifer. The impacts of saline water intrusion would be most significant near the Sea and would diminish away from the Sea.

Effect of Alternative 1 with Reduced Inflows

With reduced flows, the elevation of the Sea may decline by as much as 10 ft by 2030. A decline in Sea level would lower the base level of the regional aquifer and would temporarily increase the rate of ground water flow toward the Sea. Over time, the regional ground water table would decline. These effects would occur gradually, just as the rise in the elevation of the Sea in the past has probably caused the regional water table to rise. One of the effects of lowering the elevation of the Sea would be to induce more ground water to flow toward the Sea from storage in the aquifer. The increased ground water flow would probably be small relative to surface flows, but would temporarily offset some of the decrease in surface inflows, and thereby damping the rate of decline in the elevation of the Sea. Similarly, as the elevation of the sea rises, some of the Sea water would go into storage in the aquifer, reducing to a small extent, the rate of elevation increase. The magnitude of these effects cannot be accurately predicted with the information available.

The Salton Sea is not hydraulically connected to the perched water table created by irrigation water percolating to shallow depths. This shallow ground water, which is often drained with tile drains, is one of the principal sources of inflow to the Sea. Therefore, changes in irrigation and the volume of return flows are not expected to have much effect on ground water conditions throughout the Imperial Valley and other areas with perched ground water.

The impacts of reductions in Sea level and the potential impacts of increased ground water use would be the same under Alternative 1 as for the No Action Alternative, except that the declines in Sea level might not be as large for Alternative 1. The difference in the effects would be minor.

Importation of flood flows could affect the local ground water hydrology in the vicinity of the streams used as conveyances. For example, the upper reach of the Alamo River is a recharge area. Some of the flow in the stream seeps to the underlying aquifer. The amount of seepage could be greatly increased compared to current conditions when flood flows are imported. The recharge would be stored in the aquifer and would benefit future ground water users. However, the losses from the stream would reduce the quantity of the flood flows that reach the Sea.

No significant ground water impacts are expected to result from operation of the North Wetland Habitat or the Pupfish Pond. However, since the elevation of the water in the ponds would be maintained at –227 ft, while the elevation of the Sea would eventually decline to a minimum of –237 ft by 2030, it is possible that some seepage from the ponds to the water table would occur locally. The shallow sediments in the shoreline areas tend to be composed of very fine-grained materials, containing a high proportion of silts and clays, however. The permeability of this material is expected to be very low. Therefore, the rate of seepage from the ponds is likely to be low.

4.2.6 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

The impacts on ground water under Alternative 2 would be derived from changes in the elevation and salinity of the Sea, as described for the No Action Alternative. The effects generally would be similar for similar changes in elevation. The elevation of the Sea is expected to increase by about three feet by 2030 under the No Action Alternative, while it is projected to decline by about six feet under Alternative 2. Thus, the effect would be to cause a lowering, rather than a rise, in the regional water table. Lowering of the regional water table would occur due to draining of ground water stored in the aquifer into the Sea. As described for Alternative 1, this increased inflow of ground water to the Sea would offset some of the elevation decline projected by modeling.

The impacts from importation of flood flows would be the same as those described above for Alternative 1.

Operation of the salt collection and concentration ponds of the EES system could cause large quantities of salt to percolate to the underlying water table. The brine would flow with the ground water toward the Salton Sea. To reduce leakage, the ponds would be lined with fine-grained soils. A small volume of brine may reach the aquifer, but it would increase the salinity of the ground water only downgradient of the EES between the EES and the Salton Sea. Provided that there are no ground water wells in the vicinity, the effects would not be significant. Ground water close to the margins of the Sea is expected to be of low quality, and pumping it would induce saline water intrusion from the Sea. It is unlikely that much brine would leak from the concentration ponds. The concentrated salts on the bottom of the ponds would precipitate and clog the soil pores, reducing or preventing further infiltration of water. In effect, the crystallization of salt would act as a liner in the bottom of the ponds.

Effect of Alternative 2 with Reduced Inflows

With reduced inflows the impacts on ground water would be similar to those described above and for the No Action Alternative. The decrease in elevation projected to result from Alternative 2 would be only one to three feet greater throughout Phase 1 than the projected decline in elevation under the No Action Alternative.

The impacts from importation of flood flows would be the same as those described above for Alternative 1.

4.2.7 Alternative 3

Effect of Alternative 3 with Continuation of Current Inflow Conditions

The impacts on ground water resources in general would be the same as those described for Alternative 2, with the exception of one local impact. Seepage from the brine collection ponds of the EES system sited at the former Salton Sea Test Base could result in a significant increase in the salinity of flows in San Felipe Creek. Brine seepage from the collection ponds may create a mound of saline recharge on the shallow aquifer from which flow will radiate outward. Most of the flow will be in the direction of the established gradient, toward the Salton Sea. However, due to the proximity of a portion of the EES installation to the incised channel of San Felipe Creek, some of the flow may discharge in the channel or banks of the creek. This would dramatically increase the salinity of the waters of the creek, especially during low flow periods.

Effect of Alternative 3 with Reduced Inflows

The impacts on ground water resources would be the same as those described for alternative 3 with current inflows, above.

4.2.8 Alternative 4

Effect of Alternative 4 with Continuation of Current Inflow Conditions

The impacts on ground water resources due to changes in elevation of the Sea would be intermediate between the impacts of the No Action Alternative and of Alternative 2. An initial rise in elevation of the Sea would be followed by a moderate decline in the elevation of the Sea.

Effect of Alternative 4 with Reduced Inflows

The effects of elevation change in the Sea on ground water levels in the regional aquifer would be similar to those described for Alternative 2 with reduced inflows.

4.2.9 Alternative 5

Effect of Alternative 5 with Continuation of Current Inflow Conditions

The impacts on the regional ground water table from changes in the elevation of the Salton Sea would be nearly identical to those described for alternative 2. Since the EES would be placed within the north pond in the Sea, there would be no impacts on ground water from seepage of saline water.

Effect of Alternative 5 with Reduced Inflows

The impacts on ground water resources would be nearly identical to those described for alternative 4.

4.2.10 Cumulative Effects

The discussion of impacts in the preceding section acknowledges the range of potential cumulative effects of other existing or foreseen projects on the water balance of the study area. Implementation of the project alternative is not expected to contribute further to cumulative ground water impacts from other projects in the study area.

4.2.11 Mitigation Measures

The extraction of ground water should be carefully monitored to identify the occurrence of saline water intrusion. It may be possible to reduce the potential impacts of saline water intrusion by accompanying any ground water extraction necessary to lower the water table near the Sea by injecting freshwater upgradient to create a hydraulic barrier to further inland saline water intrusion. The extracted ground water could be discharged back to the Sea.

Impacts of brine seepage from the EES at the former Salton Sea Test Base on surface water in San Felipe Creek could be reduced by lining the ponds. The significance of the impacts on San Felipe Creek would be judged relative to its effects on pupfish or other aquatic species. A monitoring program should be implemented to identify whether these impacts occur. The monitoring program should include ground water flow monitoring and ground water quality sampling. If impacts appear likely, then mitigation might include diluting the salinity in the creek by diverting fresher flows to the creek from drains or other sources.

4.2.12 Potentially Significant Unavoidable Impacts

No significant unavoidable impacts to ground water resources are expected to result from implementing the project alternatives.

4.3 GEOLOGY AND SOILS

4.3.1 Summary of Environmental Consequences

Potentially significant impacts to the proposed evaporation ponds, displacement dike, and EES facilities are related to the structural damage that could be caused by seismic activity in the Salton Trough. The potential for damage is related primarily to ground rupture and ground acceleration; although the associated potential for structural damage due to liquefaction and dynamic settlement also could have significant impacts. Seiches could affect the evaporation ponds by causing the brine in the ponds to mix with Salton Sea water by overtopping the dikes. Such mixing could also occur along the Southwest shoreline shorebird/pupfish protection pond associated with the evaporation pond. Less than significant impacts are related to the foundation materials on which these facilities would be constructed. The possibility of expansive or corrosive soils, compaction potential, stormwater, and wind erosion, should be considered in designing and siting these facilities.

For the No Action Alternative with continuation of existing inflows, no direct impacts to unique geologic resources or significant changes to geologic resources are anticipated. The No Action Alternative with reduced inflows would not result in significant changes to geologic resources; however, additional bottom sediments would be exposed around the perimeter of the Sea. Some of these sediments contain elevated levels of some chemical constituents of concern, such as heavy metals and volatile organic compounds.

Alternative 1 would have potentially significant impacts related to ground rupture and ground acceleration and less than significant impacts related to liquefaction and dynamic settlement, landsliding, seiches, compaction, expansive soils, erosion, corrosive soils, and disturbance of potentially hazardous Sea bottom sediments. Alternative 1 would have no impacts on unique geologic features.

Alternatives 2 and 3 under current inflow conditions would have less than significant impacts related to ground rupture, ground acceleration, liquefaction and dynamic settlement, landsliding, seiches, compaction, expansive soils, erosion, and corrosive soils. Alternative 2 also would have less than significant impacts on unique geologic features. Alternatives 2 and 3 would have no impacts on potentially hazardous Sea bottom sediments, and Alternative 3 would have no impacts on unique geologic features. Under reduced inflow conditions with the construction of a displacement dike, both Alternatives 2 and 3 would have potentially significant impacts related to ground rupture and ground acceleration.

Alternatives 4 and 5 would have potentially significant impacts regarding ground rupture and ground acceleration and less than significant impacts related to liquefaction and dynamic settlement, landsliding, seiches, compaction, expansive soils, erosion, corrosive soils, and disturbance of potentially hazardous Sea bottom sediments. Alternatives 4 and 5 would have no impacts on unique geologic features. All alternatives would result in more exposure of currently submerged bottom sediments when compared to the No Action Alternative scenarios.

4.3.2 Significance Criteria

A project alternative may result in significant geologic impacts if the physical actions taken during construction or operation could directly or indirectly affect the physiography, geology, or vulnerability to geologic hazard of the project area or region. Significant impacts could result from impacts involving unique geologic or physical features, or exposure of people to impacts associated with: fault rupture; seismic ground shaking; seismic ground failure; liquefaction; seiches; tsunamis; volcanic hazards; expansive soils; severe erosion; changes in topography; unstable soil conditions from excavation, grading, or fill; landslides or mudflows; or subsidence of the land.

4.3.3 Assessment Methods

The effects of project alternatives on geology and soils are analyzed by comparing the baseline topography, stratigraphy, soils and sediments, mineral resources, landforms, slope stability, and seismic hazard conditions identified for the project area against the conditions generated by the construction and operation of each alternative, including the No Action Alternative. The analysis is based on the susceptibility of the project area to geologic hazards. This assessment takes into consideration the proximity of active faults, frequency and types of seismic events, existing ground acceleration data and models, and the type of soils and their engineering properties, the probability of disturbing Salton Sea sediments or any of the geologic features and resources unique to the area. Regulatory constraints concerning these resources also are considered.

The effects of each alternative and the severity of these effects are evaluated based on the significance criteria for geology and soils impacts. Several of the alternatives will require earthwork and borrow materials and will involve installing structures within the study area. The effects of each of these alternatives on topography, soils and sediments, mineral resources, landforms, and slope stability is evaluated based on the design of the alternative, volume of earthmoving and grading, the amount of borrow material needed, size, shape, and use of structures specified or estimated for each alternative. The probability of each alternative encountering geologic hazards is evaluated using the project area assessment of the proximity of active faults, frequency and types of seismic events, existing ground acceleration data and models, and the type of soils and their engineering properties. Mitigation measures that could reduce the severity of identified impacts and incorporate applicable regulatory requirements also are identified, as appropriate.

4.3.4 No Action Alternative

Effect of No Action Alternative with Continuation of Current Inflow Conditions

With the continuation of current inflow conditions to the Sea under the No Action Alternative, the level of the Sea would not change substantially over time. Recent projections indicate that the elevation would increase slightly from the current level of about –227 feet to approximately –224 feet over the next 100 years. This increase would not result in the inundation of unique geologic resources or in significant changes to geologic resources.

Effect of No Action Alternative with Reduced Inflows

For inflows of 1.06 maf/yr under the No Action Alternative, the elevation of the Sea would drop from the current level of approximately –227 feet to about -234 feet. The Sea would reach this level after about 30 years, after which the elevation would fluctuate around this level, provided inflows remained constant. This drop would not result in significant changes to geologic resources; however, additional bottom sediments totaling approximately 16,000 acres would be exposed around the perimeter of the Sea. As shown in a recent study by Levine-Fricke (1999), these exposed sediments would include elevated concentrations of zinc and copper at the northern tip of the Sea, nickel along most of the shoreline except the southern end, and cadmium along the northeast and central eastern shoreline.

4.3.5 Alternative 1

Effect of Alternative 1 with Current Inflow Conditions

Alternative 1 with current inflow conditions includes implementation of the common actions (described in Chapter 5) plus construction of two evaporation ponds along the southwest shore of the Sea and a pupfish pond adjacent to the south evaporation pond.

Alternative 1 would result in a decrease of the Sea's elevation to –229 at the end of Phase 1. This drop would result in exposure of approximately 26,000 acres of currently submerged bottom sediments and rocky substrate when compared to current conditions. Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 1 with current inflow conditions than under the No Action Alternative.

The size and extent of the numerous dikes and proposed (including the displacement dike proposed under Alternative 1, reduced inflow) will require a sizable borrow area and will result in the extraction of a considerable amount of rock. While a potential borrow area has identified within the Torres Martinez Indian reservation, it has not been evaluated with respect to potential geologic hazards or constraints and geologic evaluation will need to be conducted prior to removal of material. It is possible that there could be a significant impact to local geologic resources due to the large quantities of material that would be removed.

North and South Evaporation Ponds (98 kaf/yr)

Unique Geologic Features. Creation and operation of the evaporation ponds is not expected to adversely affect any of the unique geologic features in the area. The sand hills and the volcanic remnants to the southeast of the sea would be avoided during construction by ensuring that construction vehicles do not enter these sensitive areas and would not be affected by the presence of the diked evaporation ponds.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and also could extend beneath the Sea itself. This could result in significant adverse effects on the evaporation ponds. Rupture along these or previously unknown fault structures that could underlie the area of the evaporation ponds, due to an earthquake along these or other nearby faults, could cause the dikes that retain these ponds to fail. Rupture of the dikes would result in the pond contents infiltrating the Sea, which could cause a sudden large increase in salinity, with consequent deleterious effects on aquatic life.

Ground Acceleration. The peak ground acceleration for the maximum credible earthquake in the area of the proposed evaporation ponds is estimated to be .60 g for a 7.0 magnitude earthquake along the Superstition Hills or Elmore Ranch Fault. An earthquake of this magnitude could have an intensity in the vicinity of the Salton Sea of IX on the Mercalli scale, which could result in significant damage to the dikes retaining the evaporation ponds. A single event of intense motion may contribute less to cumulative structural effect than several periods of less intense ground motion, which eventually could lead to dike failure if reinforcement against such loads were not incorporated into the design of the dikes. Repeatable high ground acceleration generally is estimated at 65 percent of peak acceleration for areas within 20 miles of an earthquake epicenter and approaching 100 percent at greater distances. The repeatable high ground acceleration in the area of the Salton Sea is estimated to range from 0.15g to 0.40g.

Liquefaction and Dynamic Settlement. Locating the dike structures in areas subject to liquefaction would subject these structures to damage during a major earthquake. During a strong earthquake, liquefaction could occur throughout areas underlain by a shallow water table and loose, sandy sediments. The surface sediments in the vicinity of the southern evaporation pond have a relatively low sand content and high silt content; therefore, liquefaction would be unlikely in this area. The western evaporation pond barrier is in an area where sediments have a relatively high sand content, making the dike for the western evaporation pond more subject to potential liquefaction. Dredging down to more stable material, which is planned as part of dike construction, would minimize the potential for liquefaction and differential settlement to less than significant levels.

Landsliding. In general, landsliding is not anticipated to affect the integrity of the retention dikes surrounding the evaporation ponds due to the level area where the evaporation ponds would be constructed. However, the dikes would be sloped and could be subject to seismically induced failure, which would be a less than significant possibility provided that proper design parameters, such as degree of compaction along with slope and stabilizing features, are incorporated into the design of the dikes.

Seiches. The potential for wave-like or oscillatory movement in the Salton Sea and in the evaporation ponds from an earthquake causing dike over-topping and saline solution in the ponds mixing with the Sea water would be less than significant. It would be unlikely that quantities of the shallower pond water would wash over the top of the dike into the deeper Sea water.

Disturbance of Bottom Sediments. The disturbance of bottom sediments during pond construction is not expected to have a significant impact. The dike structures and both ponds would be built in an area of the Sea with relatively high nickel concentrations in bottom sediments (Levine-Fricke 1999). However, high concentrations of other potentially deleterious elements have not been shown to be present in the area of the evaporation ponds. The sediments containing nickel would likely be disturbed by dike construction and dredging and redistributed within the Sea during discharge of the dredged material. The dikes would not disturb sediments in the areas of the highest observed selenium concentrations (Levine-Fricke 1999); therefore, remobilization of selenium into Salton Sea water for potential biological uptake would be at low levels.

Compaction. The process of dredging materials from the dike foundation area would likely remove unstable material so that the dike foundations would rest on firm material, which would be less subject to compaction.

Expansive Soils. The possibility of expansion due to clayey nature of material under the pond barriers would be a less than significant impact with the appropriate site-specific study and preparation prior to construction. The most recent sediment studies have indicated relatively high percentages of clays in the sediments in the southern area of the western evaporation pond and the northern portion of the southern evaporation pond. These sediments are currently saturated and probably would be removed during dredging for the dike foundations; however, the underlying sediments could be of a similar clay content.

Erosion. The effects of wind and erosion due to wave action on the evaporation pond dikes would be minimized to a less than significant level by the use of proper compaction and stabilization measures in constructing the dikes.

Corrosive Soils. Potentially corrosive soils could damage foundations and subsurface structures, such as pipes and drainage channels, and should be identified during a geotechnical investigation for the evaporation ponds. Proper design of subsurface structures would minimize this impact to a less than significant level.

North Wetland Habitat

Unique Geologic Features. The area identified for the north wetland habitat does not include unique geologic features. No impacts are expected as a result of this action.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and could extend beneath the Sea itself. While the southern portion of the Salton Sea clearly has a much greater rate of seismicity than does the northern area, rupture along previously unknown faults that may underlie the area of the north shorebird and pupfish protection pond could affect these structures. Depending on the extent of the damage and the level of Sea water relative to the level of pond water, short term impacts could be significant to less than significant. Repairs to damaged structures would be made under the long-term operation and management program for the Salton Sea

Restoration Project, reducing the potential for these impacts to a less than significant level.

Ground Acceleration. The impacts would be similar to those described for the pupfish pond, Alternative 1.

Liquefaction and Dynamic Settlement. Liquefaction and dynamic settlement are not likely to impact this action due to the construction techniques and underlying soils present in the area.

Landsliding. Landsliding is not expected to significantly affect the area of the north shorebird and pupfish protection pond.

Seiches. The impacts would be similar to those described for the evaporation ponds.

Disturbance of Bottom Sediments. The impacts would be similar to those described for the evaporation ponds.

Compaction. The impacts would be similar to those described for the evaporation ponds.

Expansive Soils. The impacts would be similar to those described for the evaporation ponds.

Erosion. Material eroded from within the various agricultural drains that would enter the north shorebird and pupfish protection pond would be trapped within the pond due to its isolation from the rest of the Sea. This increased sedimentation would adversely affect the operation and maintenance of the pond, potentially requiring frequent dredging, particularly after storm events. Depending on the frequency, dredging would also create a disturbance with potential adverse effects to the invertebrates, fish, shorebirds and pupfish inhabiting the pond. Potential for this impact should be taken into consideration during design of the pond.

Corrosive Soils. The impacts would be similar to those described for the evaporation ponds.

Pupfish Pond

Unique Geologic Features. Creation and operation of the pupfish pond is not expected to adversely affect any of the unique geologic features in the area.

Ground Rupture. The impacts of ground rupture on the pupfish pond would be similar to those described for the evaporation ponds. Failure of the dikes could cause a rapid mixing of the pond water with the Sea water, and result in a large increase of salinity within the pond. This rapid change could be deleterious to aquatic life, particularly the endangered pupfish.

Ground Acceleration. The impacts would be similar to those described for the evaporation ponds.

Liquefaction and Dynamic Settlement. The surface sediments in the vicinity of the pupfish pond have a relatively low sand content and high silt content; therefore liquefaction and dynamic settlement would be unlikely in this area.

Landsliding. The impacts would be similar to those described for the evaporation ponds.

Seiches. The impacts would be similar to those described for the evaporation ponds.

Disturbance of Bottom Sediments. The impacts would be similar to those described for the evaporation ponds.

Compaction. The impacts would be similar to those described for the evaporation ponds.

Expansive Soils. The impacts would be similar to those described for the evaporation ponds.

Erosion. Material eroded from within the San Felipe Creek drainage and the various agricultural drains that would enter the pupfish pond would be trapped within the pond due to its isolation from the rest of the Sea. This increased sedimentation would adversely affect the operation and maintenance of the pond, potentially requiring frequent dredging, particularly after storm events. Depending on the frequency, dredging would also create a disturbance with potential adverse affects to the invertebrates, shorebirds and pupfish inhabiting the pond. Potential for this impact should be taken into consideration during design of the pond.

Corrosive Soils. The impacts would be similar to those described for the evaporation ponds.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of Alternative 1 with reduced inflows would be similar to those described above for Alternative 1 under current inflow conditions, with the additional effect of increased exposure of Salton Sea sediments around the perimeter of the Sea. With reduced inflows by the end of Phase 1, the Sea elevation would be 10 feet below the current elevation. This would result in exposure of a band of sediments and rocky substrate totaling approximately 53,000 acres that are currently submerged. This is approximately 37,000 acres more than under the No Action Alternative with reduced inflows. Sediments with elevated concentrations of zinc and copper would be exposed near the mouth of the Whitewater River. Relatively high concentrations of nickel have been identified in sediments that would be exposed along most of the Salton Sea shoreline except the southern shore. Sediments containing elevated cadmium levels would be exposed between Corvina Beach and North Shore and just south of Corvina

Estates along the eastern shore (Levine-Fricke 1999). Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 1 with reduced inflows than under the No Action Alternative with reduced inflows.

Alternative 1 with reduced inflow conditions also includes impacts resulting from construction of: a displacement dike; a southeast shorebird and pupfish protection pond/island protection pond that includes some deep water habitat; and a north shorebird and pupfish protection pond. These impacts are discussed below.

Displacement Dike

Unique Geologic Features. The area identified for the displacement dike is currently within the Sea and construction is not expected to affect any unique geologic features. The volcanic remnants southeast of the Sea would be avoided during construction by ensuring that construction vehicles do not enter this sensitive area.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and also could extend beneath the Sea itself. This could result in significant adverse effects on the displacement dike. Rupture along these or previously unknown fault structures that could underlie the area of the dike, due to an earthquake along these or other nearby faults, could cause the dike to fail. Rupture of the dike would result in flooding of the land behind the dike by the Sea, which could cause a drop in the overall Sea elevation.

Ground Acceleration. The peak ground acceleration for the maximum credible earthquake in the area of the proposed displacement dike is estimated to be .70 g for a 7.0 magnitude earthquake along the Elmore Ranch Fault. An earthquake of this magnitude could have an intensity in the vicinity of the Salton Sea of IX on the Mercalli scale, which could result in significant damage to the dike. A single event of intense motion may contribute less to cumulative structural effect than several periods of less intense ground motion, which eventually could lead to dike failure if reinforcement against such loads were not incorporated into the dike design. Repeatable high ground acceleration generally is estimated at 65 percent of peak acceleration for areas within 20 miles of an earthquake epicenter and approaching 100 percent at greater distances. The repeatable high ground acceleration in the area of the Salton Sea is estimated to range from 0.15g to 0.40g.

Liquefaction and Dynamic Settlement. The surface sediments in the vicinity of the displacement dike have relatively high clay and silt content and relatively low sand content; therefore, liquefaction would be unlikely in this area.

Landsliding. In general, landsliding is not expected to affect the integrity of the displacement dike. However, the dike would be sloped and could be subject to seismically induced failure, which would be a less than significant possibility provided that proper design parameters, such as degree of compaction, along with slope and stabilizing features, are incorporated into the design.

Seiches. The potential for wave-like oscillatory movement in the Salton Sea from an earthquake could cause dike over-topping and subsequent flooding of the land behind the displacement dike. This is not expected to be a significant impact.

Disturbance of Bottom Sediments. The disturbance of bottom sediments during dike construction is not expected to have a significant impact. The dike structure would be built in an area of the Sea with moderate levels of cadmium in the bottom sediments (Levine-Fricke 1999). However, high concentrations of other potentially deleterious elements have not been shown to be present in either the dike area or the submerged area that would be exposed behind the dike.

Compaction. The process of dredging materials from the dike foundation area would likely remove unstable material so that the dike foundation would rest on firm material, which would be less subject to compaction.

Expansive Soils. The possibility of expansion due to clay content under the dike would be a less than significant impact with the appropriate site-specific study and preparation prior to construction. The most recent sediment studies indicate relatively high percentage of clay in the sediments on the west side of the displacement dike location. These sediments are currently saturated and probably would be removed during dredging for the dike foundation; however, the underlying sediments could have similar clay content.

Erosion. The effects of wind and erosion due to wave action on the displacement dike would be minimized to a less than significant level by the use of proper compaction and stabilization measures during construction.

Corrosive Soils. Potentially corrosive soils could damage foundations and subsurface structures, such as pipes and drainage channels, and should be identified during a geotechnical investigation for the displacement dike. Proper design of subsurface structures would minimize this impact to a less than significant level.

Southeast Shorebird and Pupfish Protection Pond/Island Protection with Deep Water Habitat

Unique Geologic Features. The area identified for the southeast shorebird and pupfish protection pond/island protection with deepwater habitat includes Mullet Island. Construction of the pond is expected to protect this feature within a dike. Maintenance of the pond is expected to avoid this feature. No other unique geologic features have been identified at this site.

Ground Rupture. The San Andreas Fault extends through the area south of Bombay Beach. Ground rupture along this and previously unknown faults could damage the z-shaped dike structures to be built there. Depending on the extent of the damage and the level of Sea water relative to the level of pond water, short term impacts could be significant to less than significant. Repairs to damaged structures would be made under the long-term operation and management program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Ground Acceleration. The impacts would be similar to those described for the pupfish pond, Alternative 1.

Liquefaction and Dynamic Settlement. Liquefaction and dynamic settlement are not likely to impact this action due to the construction techniques and underlying soils present in the area.

Landsliding. Landsliding is not expected to significantly affect the area of the southeast shorebird and pupfish protection pond/island protection with deep water habitat.

Seiches. The impacts would be similar to those described for the evaporation ponds.

Disturbance of Bottom Sediments. The impacts would be similar to those described for the evaporation ponds.

Compaction. The impacts would be similar to those described for the evaporation ponds.

Expansive Soils. The impacts would be similar to those described for the evaporation ponds.

Erosion. Material eroded from within the various agricultural drains that would enter the southeast shorebird and pupfish protection pond would be trapped within the pond due to its isolation from the rest of the Sea. This increased sedimentation would adversely affect the operation and maintenance of the pond, potentially requiring frequent dredging, particularly after storm events. Depending on the frequency, dredging would also create a disturbance with potential adverse effects to the invertebrates, fish, shorebirds and pupfish inhabiting the pond. Potential for this impact should be taken into consideration during design of the pond.

Corrosive Soils. The impacts would be similar to those described for the evaporation ponds.

4.3.5 Alternative 2

Alternative 2 with current inflow conditions includes implementation of the common actions (described in Chapter 5) plus construction of an Enhanced Evaporation System (EES) located north of Bombay Beach capable of processing 150 kaf/yr of Salton Sea water using a showerline technology. A southeast shorebird pond/island protection with deep water habitat would also be constructed.

Effect of Alternative 2 with Current Inflow Conditions

Alternative 2 with current inflow conditions would result in a decrease in the Sea's elevation to –232 by the end of Phase 1. This drop would result in exposure of approximately 11,000 acres of currently submerged bottom sediments and rocky substrate compared to current conditions. Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 2 with current inflow conditions than under the No Action Alternative.

EES Located North of Bombay Beach(150 kaf/yr – showerline technology)

Unique Geologic Features. The area identified for the EES facility at Bombay Beach includes the Bat Caves Buttes area at the northwestern corner of the EES site. Construction and operation of the EES facility is expected to avoid this feature. No other unique geologic features have been identified at this site.

Ground Rupture. Both the Calipatria Fault and the Coachella Branch of the San Andreas Fault extend through the area of Bombay Beach. Ground rupture along these or previously unknown fault structures could damage the system of interconnected towers that make up the EES, cause structural damage to the catchment basin, and rupture the intake pipe for the system. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Ground Acceleration. The potential peak and maximum repeatable ground acceleration in the area of Bombay Beach would be the same as described under Alternative 1. A single event of intense motion or a series of less intense seismic events could damage the EES towers and system of interconnected hoses, cause structural damage to the catchment basin, and rupture the intake pipe. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Liquefaction and Dynamic Settlement. Soils in the area of Bombay Beach are made up of the sands, silts, and clays of the basin of former Lake Cahuilla (US Department of Agriculture Soil Conservation Service 1979; US Department of Agriculture Soil Conservation Service 1981). These soils in general tend to be well-drained, except those adjacent to the Sea, and in general the water table in the area is not high. Liquefaction and dynamic settlement therefore would not be likely to occur in the area of the Bombay Beach EES.

Landsliding. Landsliding is not expected to significantly affect the EES area at Bombay Beach due to the absence of steep slopes.

Seiches. Earthquake-induced seiches in the Salton Sea could affect the Bombay Beach EES site if the waves generated were large enough to reach the facility. The literature concerning seismic activity in the area does not indicate that seiches have been historically significant in the area, and the likelihood of seismic activity producing waves large enough to affect this site is small. Therefore this would be a less than significant impact.

Disturbance of Bottom Sediments. Construction and operation of the EES at Bombay Beach would not disturb Salton Sea bottom sediments.

Compaction. No significant impacts related to compaction are expected as a result of the proposed Bombay Beach EES. However, if localized areas susceptible to compaction are identified during construction, the effects could be mitigated through standard construction techniques, such as the placement of more stable materials at the tower foundations and catchment basin.

Expansive Soils. Expansive soils are not expected to significantly affect the proposed EES facility at Bombay Beach. The proposed catchment basin would be lined, which would control the addition of moisture to any clayey soils.

Erosion. The proposed Bombay Beach EES site may be subject to both wind and stream erosion. Substantial winds are common in the Salton Basin, and several stream channels cross the site. Storm runoff in these channels could erode disturbed areas unless measures are developed to protect the towers and catchment basin.

Corrosive Soils. Potentially corrosive soils could have the significant impact of damaging the intake pipe. Soils along the Sea margin are highly saline, and salt-resistant construction materials should be used for any subsurface structures in this area.

Southeast Shorebird and Pupfish Protection Pond/Island Protection with Deep Water Habitat

The impacts would be the same as described under Alternative 1, reduced flows.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of Alternative 2 with reduced inflows would be similar to those described above for Alternative 2 with current inflow conditions however, with reduced inflows by the end of Phase 1, the Sea elevation would be 10 feet below the current elevation. This would result in exposure of a band of sediments and rocky substrate totaling approximately 37,000 acres that are currently submerged. This is approximately 21,000 acres more than under the No Action Alternative with reduced inflows. Sediments with elevated concentrations of zinc and copper would be exposed near the mouth of the Whitewater River. Relatively high concentrations of nickel have been identified in sediments that would be exposed along most of the Salton Sea shoreline except the southern shore. Sediments containing elevated cadmium levels would be exposed between Corvina Beach and North Shore and just south of Corvina Estates along the eastern shore (Levine-Fricke 1999). Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 2 with reduced inflows than under the No Action Alternative with reduced inflows.

Alternative 2 also includes the addition of impacts resulting from construction of: a displacement dike; a pupfish pond; a north shorebird and pupfish protection pond; and imported flood flows. These impacts are discussed below.

Displacement Dike

The impacts would be the same as described under Alternative 1, reduced flows.

Pupfish Pond

The impacts would be the same as described under Alternative 1, reduced flows.

North Shorebird and Pupfish Protection Pond

The impacts would be the same as described under Alternative 1, reduced flows.

Import Flood Flows

Unique Geologic Features. Flood flows would be brought to the Salton Sea through existing facilities and therefore no unique geologic features would be impacted by this action.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and are crossed by the existing water conveyance facilities. Rupture due to an earthquake along these or previously unknown fault structures that underlie the area could result in significant adverse effects to the water conveyance facilities. If a rupture coincided with the transfer of floodflows, significant water loss could occur. However, operation and maintenance of these structures consistent with standard earthquake design requirements would reduce this impact to less than significant levels.

Ground Acceleration. The impacts would be similar to those described in Alternative 1, current inflow conditions.

Liquefaction and Dynamic Settlement. No impacts from this action are anticipated.

Landsliding. No impacts from this action are anticipated.

Seiches. No impacts from this action are anticipated.

Disturbance of Bottom Sediments. No impacts from this action are anticipated.

Compaction. No impacts from this action are anticipated.

Expansive Soils. No impacts from this action are anticipated.

Erosion. This action includes improvements and some minor maintenance of evacuation areas to the Sea. Since the amount of flood flows anticipated is within the current capacity of the channels indicated for use, less than significant impacts due to erosion are anticipated.

Corrosive Soils. No impacts from this action are anticipated.

4.3.6 Alternative 3

Alternative 3 with current inflow conditions includes implementation of the common actions (described in Chapter 5) plus construction of an Enhanced Evaporation System (EES) located on the Salton Sea Test Base capable of processing 150 kaf/yr of Salton Sea water using a showerline technology. A southeast shorebird pond/island protection with deep water habitat would also be constructed.

Effect of Alternative 3 with Current Inflow Conditions

Alternative 3 with current inflow conditions would result in a decrease of approximately 5 feet in the Sea's elevation to –232 by the end of Phase 1. This drop would result in exposure of approximately 11,000 acres of currently submerged bottom sediments and rocky substrate compared to existing conditions. Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 3 with current inflow conditions than under the No Action Alternative.

EES Located at the Salton Sea Test Base (150 kaf/yr – showerline technology)

Unique Geologic Features. The area identified for the Salton Sea Test Base EES facility does not include unique geologic features. The sand dunes to the south of the test base would be just south of the test base EES facility boundary.

Ground Rupture. No known fault structures extend through the test base EES site; therefore, ground rupture along known faults would not have a significant impact on this facility. However, ground rupture along previously unknown faults, given the high level of seismic activity in the area, could damage the system of interconnected towers that make up the EES, cause structural damage to the catchment basin, and rupture the intake pipe for the system. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Ground Acceleration. As described for the Bombay Beach EES site, potentially significant ground acceleration impacts could occur to the Salton Sea Test Base EES facility if seismic shaking is not taken into account in the facility's design. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Liquefaction and Dynamic Settlement. Soils in the area of the test base are made up of the sands, silts, and clays of the lacustrine basin of former Lake Cahuilla and alluvial fans(US Department of Agriculture Soil Conservation Service 1979; US Department of

Agriculture Soil Conservation Service 1981). These soils in general tend to be well drained except for those adjacent to the Sea, and in general the water table in the area is not high. Liquefaction and dynamic settlement therefore would not be likely to occur in the area of the Salton Sea Test Base EES.

Landsliding. Landsliding is not be expected to significantly affect the Salton Sea Test Base EES area due to the absence of steep slopes.

Seiches. Earthquake-induced seiches in the Salton Sea could affect the Salton Sea Test Base EES site if the waves generated were large enough to reach the facility. The literature concerning seismic activity in the area does not indicate that there have been significant seiches in the area, and the likelihood of seismic activity producing waves large enough to affect this site is small. Therefore this would be a less than significant impact.

Disturbance of Bottom Sediments. Construction and operation of the Salton Sea Test Site EES would not disturb Salton Sea bottom sediments.

Compaction. No significant impacts related to compaction are expected as a result of the proposed Salton Sea Test Site EES. However, if localized areas susceptible to compaction are identified during construction, the effects could be mitigated through standard construction techniques, such as placing more stable materials at the tower foundations and catchment basin.

Erosion. The proposed Salton Sea Test Site EES site may be subject to both wind and stream erosion. Substantial winds are common in the Salton Basin, and several stream channels cross the site. Storm runoff in these channels could erode disturbed areas unless measures are developed to protect the towers and catchment basin. Effects could be mitigated by constructing diversion structures to protect the towers and catchment basin.

Corrosive Soils. Corrosive soils could have the significant impact of damaging the intake pipe. Soils along the Sea margin are highly saline, and salt resistant construction materials should be used to construct any subsurface structures in this area. In addition, soils of moderate alkalinity are found in the area of the Salton Sea Test Base site.

North Wetland Habitat

The impacts would be the same as described under Alternative 1.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of Alternative 3 with reduced inflows would be similar to those described above for Alternative 3 with current inflow conditions, however, with reduced inflows by the end of Phase 1, the Sea elevation would be 10 feet below the current elevation or approximately –237 feet. This would result in exposure of a band of sediments and rocky substrate totaling approximately 37,000 acres that are currently submerged. This is approximately 21,000 acres more than under the No Action Alternative with reduced inflows. Sediments with elevated concentrations of zinc and copper would be exposed near the mouth of the Whitewater River. Relatively high concentrations of nickel have been identified in sediments that would be exposed along most of the Salton Sea shoreline except the southern shore. Sediments containing elevated cadmium levels would be exposed between Corvina Beach and North Shore and just south of Corvina Estates along the eastern shore (Levine-Fricke 1999). Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 3 with reduced inflows than under the No Action Alternative with reduced inflows.

Alternative 3 with reduced inflows also includes the addition of impacts resulting from construction of: a displacement dike; a pupfish pond; a north shorebird and pupfish protection pond; and imported flood flows. These impacts are discussed below.

Displacement Dike
The impacts would be the same as described under Alternative 1, reduced flows.

Pupfish Pond
The impacts would be the same as described under Alternative 1, reduced flows.

Import Flood Flows
The impacts would be the same as described under Alternative 2, reduced flows.

4.3.7 Alternative 4
Alternative 4 with current inflow conditions includes implementation of the common actions (described in Chapter 5) plus construction of an Enhanced Evaporation System (EES) located at the Salton Sea Test Base capable of processing 100 kaf/yr of Salton Sea water using a showerline technology. The southwest evaporation pond described as part of Alternative 1 with a capacity of 68 kaf/yr, the pupfish pond, and the southeast shorebird pond/island protection with deep water habitat would also be constructed.

Effect of Alternative 4 with Current Inflow Conditions
Alternative 4 with current inflow conditions would result in a decrease of approximately 2 feet in the Sea's elevation to –229 by the end of Phase 1. The impact of this drop would be the similar to that described for Alternative 1, current inflow conditions.

South Evaporation Pond (68 kaf/yr) and an EES located at Salton Sea Test Base (100 kaf/yr – showerline technology)
Unique Geologic Features. Creation and operation of the south evaporation pond is not expected to adversely affect any of the unique geologic features in the area. The sand hills and the volcanic remnants to the southeast of the sea would be avoided during construction by ensuring that construction vehicles do not enter these sensitive areas and would not be affected by the presence of the diked evaporation pond.

The area identified for the Salton Sea Test Base EES facility does not include unique geologic features. The sand dunes to the south of the test base would be just south of the test base EES facility boundary.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and also could extend beneath the Sea itself. This could result in significant adverse effects on the evaporation pond. Rupture along these or previously unknown fault structures that could underlie the area of the evaporation pond, due to an earthquake along these or other nearby faults, could cause the dike that retains the pond to fail. Rupture of the dike would result in the pond contents infiltrating the Sea, which could cause a sudden large increase in salinity, with consequent deleterious effects on aquatic life.

No known fault structures extend through the test base EES site; therefore, ground rupture along known faults would not have a significant impact on this facility. However, ground rupture along previously unknown faults, given the high level of seismic activity in the area, could damage the system of interconnected towers that make up the EES, cause structural damage to the catchment basin, and rupture the intake pipe for the system. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Ground Acceleration. The peak ground acceleration for the maximum credible earthquake in the area of the proposed evaporation pond is estimated to be .60 g for a 7.0 magnitude earthquake along the Superstition Hills or Elmore Ranch Fault. An earthquake of this magnitude could have an intensity in the vicinity of the Salton Sea of IX on the Mercalli scale, which could result in significant damage to the dike retaining the evaporation pond. A single event of intense motion may contribute less to cumulative structural effect than several periods of less intense ground motion, which eventually could lead to dike failure if reinforcement against such loads were not incorporated into the design of the dike. Repeatable high ground acceleration generally is estimated at 65 percent of peak acceleration for areas within 20 miles of an earthquake epicenter and approaching 100 percent at greater distances. The repeatable high ground acceleration in the area of the Salton Sea is estimated to range from 0.15g to 0.40g.

Potentially significant ground acceleration impacts could occur to the Salton Sea Test Base EES facility if seismic shaking is not taken into account in the facility's design. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

Liquefaction and Dynamic Settlement. Locating the dike structure in an area subject to liquefaction would subject the structure to damage during a major earthquake. During a strong earthquake, liquefaction could occur throughout areas underlain by a shallow water table and loose, sandy sediments. The surface sediments in the vicinity of the southern evaporation pond have a relatively low sand content and high silt content; therefore, liquefaction would be unlikely in this area. Dredging down to more stable material, which is planned as part of dike construction, would minimize the potential for liquefaction and differential settlement to less than significant levels.

Soils in the area of the test base are made up of the sands, silts, and clays of the lacustrine basin of former Lake Cahuilla and alluvial fans(US Department of Agriculture Soil Conservation Service 1979; US Department of Agriculture Soil Conservation Service 1981). These soils in general tend to be well drained except for those adjacent to the Sea, and in general the water table in the area is not high. Liquefaction and dynamic settlement therefore would not be likely to occur in the area of the Salton Sea Test Base EES.

Landsliding. In general, landsliding is not anticipated to affect the integrity of the retention dike surrounding the evaporation pond due to the level area where the evaporation pond would be constructed. However, the dike would be sloped and could be subject to seismically induced failure, which would be a less than significant possibility provided that proper design parameters, such as degree of compaction along with slope and stabilizing features, are incorporated into the design of the dike.

Landsliding is not be expected to significantly affect the Salton Sea Test Base EES area due to the absence of steep slopes.

Seiches. The potential for wave-like or oscillatory movement in the Salton Sea and in the evaporation pond from an earthquake causing dike over-topping and saline solution in the pond mixing with the Sea water would be less than significant. It would be unlikely that quantities of the shallower pond water would wash over the top of the dike into the deeper Sea water.

Earthquake-induced seiches in the Salton Sea could affect the Salton Sea Test Base EES site if the waves generated were large enough to reach the facility. The literature concerning seismic activity in the area does not indicate that there have been significant seiches in the area, and the likelihood of seismic activity producing waves large enough to affect this site is small. Therefore this would be a less than significant impact.

Disturbance of Bottom Sediments. The disturbance of bottom sediments during pond construction is not expected to have a significant impact. The dike structure and pond would be built in an area of the Sea with relatively high nickel concentrations in bottom sediments (Levine-Fricke 1999). However, high concentrations of other potentially deleterious elements have not been shown to be present in the area of the evaporation pond. The sediments containing nickel would likely be disturbed by dike construction and dredging and redistributed within the Sea during discharge of the dredged material. The dike would not disturb sediments in the areas of the highest observed selenium concentrations (Levine-Fricke 1999); therefore, remobilization of selenium into Salton Sea water for potential biological uptake would be at low levels.

Construction and operation of the Salton Sea Test Site EES would not disturb Salton Sea bottom sediments.

Compaction. The process of dredging materials from the dike foundation area would likely remove unstable material so that the dike foundation would rest on firm material, which would be less subject to compaction.

No significant impacts related to compaction are expected as a result of the proposed Salton Sea Test Site EES. However, if localized areas susceptible to compaction are identified during construction, the effects could be mitigated through standard construction techniques, such as placing more stable materials at the tower foundations and catchment basin.

Expansive Soils. The possibility of expansion due to clayey nature of material under the pond barrier would be a less than significant impact with the appropriate site-specific study and preparation prior to construction. The most recent sediment studies have indicated relatively high percentages of clays in the sediments in the northern portion of the southern evaporation pond. These sediments are currently saturated and probably would be removed during dredging for the dike foundation; however, the underlying sediments could be of a similar clay content.

Expansive soils are not expected to significantly affect the proposed EES facility at the Salton Sea Test Base. The proposed catchment basin would be lined, which would control the addition of moisture to any clayey soils.

Erosion. The effects of wind and erosion due to wave action on the evaporation pond dike would be minimized to a less than significant level by the use of proper compaction and stabilization measures in constructing the dike.

The proposed Salton Sea Test Site EES site may be subject to both wind and stream erosion. Substantial winds are common in the Salton Basin, and several stream channels cross the site. Storm runoff in these channels could erode disturbed areas unless measures are developed to protect the towers and catchment basin. Effects could be mitigated by constructing diversion structures to protect the towers and catchment basin.

Corrosive Soils. Potentially corrosive soils could damage foundations and subsurface structures, such as pipes and drainage channels, and should be identified during a geotechnical investigation for the evaporation pond. Proper design of subsurface structures would minimize this impact to a less than significant level.

Corrosive soils could have the significant impact of damaging the intake pipe. Soils along the Sea margin are highly saline, and salt resistant construction materials should be used to construct any subsurface structures in this area. In addition, soils of moderate alkalinity are found in the area of the Salton Sea Test Base site.

North Wetland Habitat

The impacts would be the same as described under Alternative 1.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of Alternative 4 with reduced inflows would be similar to those described above for Alternative 4 with current inflow conditions, with the additional effect of increased exposure of Salton Sea sediments around the perimeter of the Sea. With reduced inflows by the end of Phase 1, the Sea elevation would be 8 feet below the current elevation or –235 feet. This would result in exposure of a band of sediments and rocky substrate totaling approximately 43,000 acres that are currently submerged. This is approximately 27,000 acres more than under the No Action Alternative with reduced inflows. Sediments with elevated concentrations of zinc and copper would be exposed near the mouth of the Whitewater River. Relatively high concentrations of nickel have been identified in sediments that would be exposed along most of the Salton Sea shoreline except the southern shore. Sediments containing elevated cadmium levels would be exposed between Corvina Beach and North Shore and just south of Corvina Estates along the eastern shore (Levine-Fricke 1999). Exposure of these sediments would not represent a significant geologic resources impact. The effect would be slightly more severe under Alternative 4 with reduced inflows than under the No Action Alternative with reduced inflows.

Alternative 4 also includes the addition of impacts resulting from construction of: a displacement dike; a north shorebird and pupfish protection pond; and imported flood flows. These impacts are discussed below.

Displacement Dike

The impacts would be the same as described under Alternative 1, reduced flows.

Import Flood Flows

The impacts would be the same as described under Alternative 2, reduced flows.

4.3.8 Alternative 5

Alternative 5 with current inflow conditions includes implementation of the common actions (described in Chapter 5) plus construction of an Enhanced Evaporation System (EES) located adjacent to the Salton Sea Test Base and within the northwest evaporation pond. This EES would be capable of processing 150 kaf/yr of Salton Sea water using a ground-based, artificial snowmaking technology. The northwest evaporation pond described as part of Alternative 1 would be used to stockpile salt precipitated out using the EES. This alternative also includes the pupfish pond, the north shorebird and pupfish protection pond, and the southeast shorebird pond/island protection with deep water habitat.

Effect of Alternative 5 with Current Inflow Conditions

Alternative 5 with current inflow conditions would result in a decrease in the Sea's elevation to –233 by the end of Phase 1. This drop would result in exposure of approximately 16,000 acres of currently submerged bottom sediments and rocky substrate compared to existing conditions. Exposure of these sediments would not represent a significant geologic resources impact but could have public health and safety and air quality ramifications. The effect would be more severe under Alternative 5 with current inflow conditions than under the No Action Alternative.

EES located within the North Evaporation Pond (150 kaf/yr – groundbased snowmaking technology)

Unique Geologic Features. Creation and operation of the north evaporation pond is not expected to adversely affect any of the unique geologic features in the area. The sand hills and the volcanic remnants to the southeast of the sea would be avoided during construction by ensuring that construction vehicles do not enter these sensitive areas and would not be affected by the presence of the diked evaporation pond.

Construction of the EES within the pond would have no adverse effects on unique geologic features.

Ground Rupture. As identified in Chapter 3, several fault zones extend into the Salton Basin and also could extend beneath the Sea itself. This could result in significant adverse effects on the north evaporation pond. Rupture along these or previously unknown fault structures that could underlie the area of the evaporation pond, due to an earthquake along these or other nearby faults, could cause the dike that retain the pond to fail. Rupture of the dike would result in the pond contents infiltrating the Sea, which could cause a sudden large increase in salinity, with consequent deleterious effects on aquatic life.

Ground rupture could temporarily disrupt use of the ground-based EES but is not expected to cause significant impact to the system.

Ground Acceleration. The peak ground acceleration for the maximum credible earthquake in the area of the proposed evaporation pond is estimated to be .60 g for a 7.0 magnitude earthquake along the Superstition Hills or Elmore Ranch Fault. An earthquake of this magnitude could have an intensity in the vicinity of the Salton Sea of IX on the Mercalli scale, which could result in significant damage to the dike retaining the evaporation pond. A single event of intense motion may contribute less to cumulative structural effect than several periods of less intense ground motion, which eventually could lead to dike failure if reinforcement against such loads were not incorporated into the design of the dikes. Repeatable high ground acceleration generally is estimated at 65 percent of peak acceleration for areas within 20 miles of an earthquake epicenter and approaching 100 percent at greater distances. The repeatable high ground acceleration in the area of the Salton Sea is estimated to range from 0.15g to 0.40g.

Liquefaction and Dynamic Settlement. Locating the dike structure in areas subject to liquefaction would subject the structure to damage during a major earthquake. During a strong earthquake, liquefaction could occur throughout areas underlain by a shallow water table and loose, sandy sediments. The northern evaporation pond barrier is in an area where sediments have a relatively high sand content, making the dike for the evaporation pond subject to potential liquefaction. Dredging down to more stable material, which is planned as part of dike construction, would minimize the potential for liquefaction and differential settlement to less than significant levels.

Liquefaction and dynamic settlement is not expected to significantly affect the ground-based EES.

Landsliding. In general, landsliding is not anticipated to affect the integrity of the retention dike surrounding the evaporation pond due to the level area where the evaporation pond would be constructed. However, the dike would be sloped and could be subject to seismically induced failure, which would be a less than significant possibility provided that proper design parameters, such as degree of compaction along with slope and stabilizing features, are incorporated into the design of the dike.

Landsliding is not expected to significantly affect the ground-based EES.

Seiches. The potential for wave-like or oscillatory movement in the Salton Sea and in the evaporation pond from an earthquake causing dike over-topping and saline solution in the ponds mixing with the Sea water would be less than significant. It would be unlikely that quantities of the shallower pond water would wash over the top of the dike into the deeper Sea water.

Dike over-topping could temporarily damage the ground-based EES, however the effect is considered less than significant.

Disturbance of Bottom Sediments. The disturbance of bottom sediments during pond construction is not expected to have a significant impact. The dike structure and pond would be built in an area of the Sea with relatively high nickel concentrations in bottom sediments (Levine-Fricke 1999). However, high concentrations of other potentially deleterious elements have not been shown to be present in the area of the evaporation pond. The sediments containing nickel would likely be disturbed by dike construction and dredging and redistributed within the Sea during discharge of the dredged material. The dike would not disturb sediments in the areas of the highest observed selenium concentrations (Levine-Fricke 1999); therefore, remobilization of selenium into Salton Sea water for potential biological uptake would be at low levels.

Construction of the ground-based EES would not disturb bottom sediments.

Compaction. The process of dredging materials from the dike foundation area would likely remove unstable material so that the dike foundation would rest on firm material, which would be less subject to compaction.

Construction of the ground-based EES would not result in compaction.

Expansive Soils. The possibility of expansion due to clayey nature of material under the pond barrier would be a less than significant impact with the appropriate site-specific study and preparation prior to construction. The most recent sediment studies have indicated relatively high percentages of clays in the sediments in the southern area of the northern evaporation pond. These sediments are currently saturated and probably would be removed during dredging for the dike foundation; however, the underlying sediments could be of a similar clay content.

Erosion. The effects of wind and erosion due to wave action on the evaporation pond dike would be minimized to a less than significant level by the use of proper compaction and stabilization measures in constructing the dikes.

Erosion is not expected to affect the ground-based EES.

Corrosive Soils. Potentially corrosive soils could damage foundations and subsurface structures, such as pipes and drainage channels, and should be identified during a geotechnical investigation for the evaporation pond and EES. Proper design of subsurface structures would minimize this impact to a less than significant level.

Pupfish Pond

The impacts would be the same as described under Alternative 1, reduced flows.

North Wetland Habitat

The impacts would be the same as described under Alternative 1, reduced flows.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of Alternative 5 with reduced inflows would be similar to those described above for Alternative 5 with current inflow conditions, with the additional effect of increased exposure of Salton Sea sediments around the perimeter of the Sea. With reduced inflows by the end of Phase 1, the Sea elevation would be 10 feet below the current elevation or –237 feet. This would result in exposure of a band of sediments and rocky substrate totaling approximately 38,000 acres that are currently submerged. This is approximately 22,000 acres more than under the No Action Alternative with reduced inflows. The impact of this would be the same as described under Alternative 1, reduced inflow conditions.

Alternative 5 with reduced inflow conditions also includes the addition of impacts resulting from construction of: a displacement dike and imported flood flows. These impacts are discussed below.

Displacement Dike

The impacts would be the same as described under Alternative 1, reduced flows.

Import Flood Flows

The impacts would be the same as described under Alternative 2, reduced flows.

4.3.9 Cumulative Effects

It is probable that the on-going and proposed water quality improvement and conservation projects in the area surrounding the Salton Sea, described in Chapter 2, would result in decreased inflows to the Sea. For analysis purposes, inflow has assumed to be reduced to an average annual value of 1.06 maf during the Phase 1 planning period. The effects of such an inflow reduction on geology and soils have been discussed for each alternative.

Expansion of the Mesquite Gold Mine would remove valuable mineral resources and would disturb substantial quantities of soil. Construction of the Mesquite Regional Landfill and the Gateway of the Americas Specific Plan Area also would require substantial soil disturbance. The proposed project in combination with these projects, however, is not expected to cause significant impacts to mineral resources or to disturb substantial quantities of agricultural soils.

4.3.10 Mitigation Measures

A detailed geotechnical evaluation undertaken as part of construction activities would identify specific areas of concern, such as the location of previously unidentified fault rupture zones, areas with unstable or corrosive soils, repeatable ground acceleration, and liquefaction potential. All mitigation measures would be supplemented and refined according to the detailed geotechnical evaluation. Impacts related to geology and soils could be minimized by incorporating the recommendations of a geotechnical expert based on site-specific investigations.

The siting and final design of the proposed new structures would take into account the location of known and previously unknown faults revealed through geotechnical investigation and the frequency and level of seismic activity in the Salton Basin. The final design of these structures (evaporation ponds and displacement dikes, EES towers and system, catchment basin, habitat protection dikes, and intake pipes), would, to the extent feasible, incorporate peak ground acceleration loading values and repeatable high ground acceleration values to minimize potentially significant structural damage from seismic activity.

Depending on the findings of site-specific investigations, additional mitigation could include replacing unsuitable base materials, using moisture control, chemical, engineering, and or drainage methods to control expansive soil behavior of clay soil, if appropriate, designing slopes to minimize seismically induced landsliding, designing subsurface pipes, monitoring settlement if appropriate, designing and constructing erosion control methods and devices, and identifying appropriate wind erosion measures, if needed. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.

4.3.11 Potentially Significant Unavoidable Impacts

The location of dikes and EES structures on unidentified faults could result in damage to these facilities due to ground rupture during a seismic event. The potential for this could be minimized by surveying the locations of the dikes for previously unidentified faults and constructing the dikes to avoid any faults discovered. However, it may not be possible to avoid these features.

Ground acceleration impacts can be mitigated by designing the dikes and the EES system to withstand ground shaking resulting from earthquakes. In this way the effects of ground shaking could be minimized but not avoided.

Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project; however, if damages to the evaporation pond dikes were sufficient to cause a substantial increase in salinity in the Sea prior to repair, the effects of these damages would be unavoidable.

4.4 AIR QUALITY

4.4.1 Summary of Environmental Consequences

- The major air quality issues associated with the various alternatives include:
- The potential for windblown dust from areas exposed by lowered water levels;
- Fugitive dust and vehicle exhaust emissions from construction activities;
- The potential for windblown salt spray from salt concentration ponds and enhanced evaporation systems; and
- Emissions from various facilities and equipment associated with fish harvesting and shoreline cleanup operations.

If Salton Sea inflows remain at current values, Salton Sea water levels would rise slightly under the No Action Alternative, remain relatively stable under Alternative 1, and decline slightly under the other restoration alternatives. Water levels in the Salton Sea would decline under all alternatives if inflows fall below current amounts.

During Phase 1, Alternatives 1, 2, 3, 4, and 5 would result in more exposure of currently submerged land than would the No Action Alternative. This situation would arise because of the south shore displacement dike feature common to all restoration alternatives. The greatest Phase 1 exposure of currently submerged lands would occur with Alternatives 2 and 3. By the end of the Phase 2 period in 2060, the greatest exposure of currently submerged lands would occur under the No Action Alternative.

Because salinity levels in the Salton Sea would remain well below saturation concentrations for all major salts, lowered water levels would not result in salt precipitation on the exposed sediments. The only compounds likely to precipitate in meaningful quantities are lime (calcium carbonate) and gypsum (hydrated calcium sulfate). These compounds do not pose any wind erosion hazard. On the contrary, precipitation of these compounds would reduce wind erosion hazards by cementing sediment particles together.

The land areas that would be exposed were dry land prior to the 1905 filling of the Salton Sea, and most of these areas also became dry land between about 1917 and 1950. These lands are expected to revegetate to a condition similar to historical conditions and adjacent upland areas. In the absence of active surface disturbance, the wind erosion potential of these areas would be similar to that of surrounding undisturbed lands. Consequently, the air quality impacts of lowered Salton Sea water levels would be less than significant.

All of the restoration alternatives would generate significant quantities of ozone precursor and PM_{10} emissions during their construction. Alternative 1 would have minimal air quality impacts during facility operation. Alternatives 2, 3, and 4 have the potential for generating significant salt drift to areas downwind of the EES during facility operation. Alternative 5 has an undetermined potential for generating salt drift to downwind areas, but differences in EES designs indicate that potential salt drift problems from the Alternative 5 EES would be significantly less than that from Alternatives 2, 3, and 4.

All restoration alternatives would require a formal Clean Air Act conformity determination to address construction-related emissions. The conformity demonstration may require state and local air quality agencies to develop SIP amendments that accommodate the selected alternative. Alternatives 2, 3, 4, and 5 would require stationary source permits from the Imperial County APCD. Alternative 3 would require additional stationary source permits from the South Coast AQMD.

4.4.2 Significance Criteria

Significant air quality impacts would occur if a project alternative would directly or indirectly:

- Produce emissions that would cause or measurably contribute to a violation of state or federal ambient air quality standards;
- Cause a net increase in pollutant emissions that exceed Clean Air Act conformity *de minimis* thresholds for ozone precursors (25 tons per year in Riverside County, 100 tons per year in Imperial County) or PM_{10} (70 tons per year in Riverside County, 100 tons per year in Imperial County);
- Establish land uses that would expose people to localized (as opposed to regional) air pollutant concentrations that violate state or federal ambient air quality standards;
- Conflict with specific air quality management plan policies or programs; or
- Foster or accommodate development in excess of levels assumed by applicable air quality management plans.

4.4.3 Assessment Methods

Potential air quality impacts have been evaluated by evaluating the chemistry of the Salton Sea and the physical condition of areas exposed by lowered water levels, by evaluating regulatory compliance issues, by estimating emissions from construction activities, and by performing screening-level dispersion modeling analyses to evaluate fugitive dust from haul road traffic and salt spray drift from enhanced evaporation systems.

To the extent that construction emissions can be quantified, those emissions have been compared to the *de minimis* thresholds in the EPA general conformity rule to determine impact significance. Other regulatory compliance issues are discussed qualitatively.

Dispersion modeling analyses have been performed using the CALINE4 model (Benson 1989). Dispersion modeling was performed to estimate the distances at which construction period haul road traffic might generate violations of PM_{10} standards or cause hazardous visibility impairment on nearby public roadways.

Dispersion modeling to evaluate salt drift from enhanced evaporations systems is very preliminary. There is insufficient design information available on facility alternatives to allow accurate estimates of operational emissions or to perform modeling analyses with sufficient refinement to rigorously determine ambient air quality impacts from EES operation. Only generalized screening-level dispersion modeling analyses of operational impacts from EES facilities are possible at this time, and results of those analyses are subject to considerable uncertainty.

Windblown Dust From Exposed Areas

The potential for air quality problems associated with areas exposed by lowered Salton Sea water levels was evaluated in a qualitative manner based on general factors important to wind erosion processes plus specific factors that have generated windblown dust problems at Mono Lake, Owens Lake, and other locations. Critical considerations include the types of dissolved salts identifiable from water quality data, the potential for salinity levels to reach saturation conditions as water levels decline, the mineralogy and wind erosion potential of important salts, the rate of water level reductions, the nature of groundwater conditions and flows, the nature of area soils, the presence of other factors that might impede revegetation of exposed sediments. Added to these considerations is the absence of evidence for significant windblown dust problems originating from existing Salton Sea shoreline areas.

Table 4.4-1 summarizes the water level changes, net exposed acreages, and nominal Salton Sea salinities for Phase 1 and Phase 2 conditions under the various alternatives and inflow scenarios. The highest salinity level predicted under any of the alternatives is the 2060 condition for the No Action Alternative with 800,000 acre-feet per year of inflow. That salinity value (17.8%) represents a mixture of several salts. Water quality data presented in Section 3.1 indicates that chlorides and sulfates are the dominant salts in the Salton Sea. At a water temperature of 20 degrees C (68 degrees F), the saturation concentration for sodium chloride is about 25.7%, and the saturation concentration for sodium sulfate is about 16.4% (Saint-Amand et al., 1986). If all the dissolved chloride in the Salton Sea were sodium chloride and all the dissolved sulfate were sodium sulfate, sodium chloride would be present at about 41% of saturation and sodium sulfate would be present at about 44% of saturation.

Table 4.4-1
Summary of Water Levels, Exposed Areas, and Nominal Salinities for Salton Sea Alternatives

		Change in Water Surface Level (ft)				Net Area Exposed (acres)				Nominal Salton Sea Salinity			
Alternative	**Inflow Scenario**	**2000**	**2015**	**2030**	**2060**	**2000**	**2015**	**2030**	**2060**	**2000**	**2015**	**2030**	**2060**
No Action	1.36 maf/yr	0	2	3	4	0	(5,057)	(7,538)	(9,678)	4.4%	4.8%	5.3%	6.4%
	1.08 maf/yr	0	-1	-7	-14	0	918	15,527	35,631	4.4%	5.2%	7.5%	12.3%
	0.80 maf/yr	0	-1	-7	-22	0	920	15,530	64,463	4.4%	5.2%	7.5%	17.8%
Alternative 1	1.36 maf/yr	0	3	-2	0	0	(9,089)	0	(3,761)	4.4%	4.3%	3.7%	2.7%
	1.08 maf/yr	0	2	-10	-5	0	8,294	27,311	18,981	4.4%	4.6%	4.6%	3.5%
	0.80 maf/yr	0	2	-10	-7	0	9,657	27,321	21,708	4.4%	4.6%	4.6%	3.8%
Alternative 2	1.36 maf/yr	0	-2	-5	-7	0	2,258	10,017	13,643	4.4%	4.7%	4.6%	3.7%
	1.08 maf/yr	0	-3	-10	-5	0	19,896	35,953	24,527	4.4%	5.1%	5.4%	3.8%
	0.80 maf/yr	0	-3	-10	-11	0	19,898	35,866	48,739	4.4%	5.1%	5.4%	4.5%
Alternative 3	1.36 maf/yr	0	-2	-5	-7	0	2,258	10,017	13,643	4.4%	4.7%	4.6%	3.7%
	1.08 maf/yr	0	-3	-10	-5	0	19,896	35,953	24,527	4.4%	5.1%	5.4%	3.8%
	0.80 maf/yr	0	-3	-10	-11	0	19,898	35,866	48,739	4.4%	5.1%	5.4%	4.5%
Alternative 4	1.36 maf/yr	0	0	-2	-2	0	(2,686)	731	1,804	4.4%	4.4%	4.0%	3.1%
	1.08 maf/yr	0	-1	-8	-5	0	13,796	25,172	20,053	4.4%	4.8%	4.7%	4.0%
	0.80 maf/yr	0	-1	-8	-7	0	15,155	25,213	24,393	4.4%	4.8%	4.8%	4.4%
Alternative 5	1.36 maf/yr	0	-2	-5	-4	0	(6,060)	(708)	(1,520)	4.4%	4.5%	4.1%	3.4%
	1.08 maf/yr	0	-3	-9	-4	0	11,498	21,550	14,445	4.4%	4.9%	4.6%	3.7%
	0.80 maf/yr	0	-3	-9	-9	0	11,506	21,512	21,843	4.4%	4.9%	4.6%	4.1%

Notes: Net exposed area calculated as the change in surface area less the size of salt concentration ponds, the North Wetlands Area, the Southwest Pupfish Pond, and the footprint of the displacement pond dikes.
Net exposed area estimates are based on data in Table 2.4-2, Table 2.4-3, and approximate sizes for the North Wetlands Area (364 acres) and the Southwest Pupfish Pond (1,368 acres).
Values shown in parentheses () under Net Area Exposed represent currently dry areas inundated by changing Salton Sea water levels.
Nominal salinity percent calculations do not account for water displaced by dissolved salts or water density differences at fluctuating water temperatures.

The review of saturation concentrations for major salts makes it clear that no salt deposition would occur as water levels drop over the foreseeable future. The average rate of water level reductions is only a few inches per year under all of the various alternatives and inflow scenarios. This rate of water level reduction provides would minimize any lag in the drainage of interstitial water from the exposed sediments. Drainage of exposed soils should allow revegetation to occur at densities typical of historical conditions or surrounding upland areas.

If perched water tables formed, that might inhibit revegetation rates. But capillary action would also encourage soil crusting, which would minimize the potential for wind erosion. When converted into chemical equivalents, the dissolved salt content of Salton Sea water is clearly dominated by chloride salts; the chloride-to-sulfate salt ratio is 3.94 to 1. Thus, any salts formed by evaporation of saline water brought to the surface by capillary action would be strongly dominated by sodium chloride. As noted by Saint-Amand et al. (1986), it has long been recognized that salt deposits dominated by chloride salts have a low potential for wind erosion.

Salts dominated by sodium sulfate, sodium carbonate, and sodium bicarbonate salts are the source of most windblown dust associated with salt deposits. The sulfate, carbonate, and bicarbonate salts undergo mineralogical phase changes in response to moisture, temperature, and carbon dioxide levels. The phase changes can convert cemented crystalline salt deposits into amorphous powders with a high potential for wind erosion (Saint-Amand, 1986; Smith et al., 1987; Alderman, 1985).

Haul Road Dust Modeling

Dispersion modeling of dust generated by haul road traffic used the CALINE4 dispersion model. PM_{10} concentrations were modeled to evaluate compliance with state and federal ambient air quality standards. Total suspended particulate matter (TSP) was modeled to assess the potential for dust-related visibility impairment near public highways. PM_{10} and TSP emission rates (767 grams per vehicle-mile for PM_{10} and 2,130 grams per vehicle-mile for TSP) were based on EPA unpaved roadway emission equations (EPA 1995) assuming typical 100-ton capacity off-road haul truck characteristics (Orelman 1998), a roadway silt plus clay fraction of 5%, and a 65% control effectiveness for dust control measures. No settling or deposition rates were used for PM_{10} modeling. TSP modeling assumed an average TSP settling rate of 7.25 centimeters per second and an average TSP deposition rate of 3.14 centimeters per second. The assumed TSP settling and deposition rates are representative of particles in the size range of 30-40 microns aerodynamic equivalent diameter. All modeling assumed neutral stability conditions, a wind fluctuation parameter of 20 degrees, and wind speeds of 1 meter per second (2.2 mph) and 3 meters per second (6.7 mph).

Maximum 10-hour workday concentrations for PM_{10} and TSP were estimated as 85% of the modeled maximum 1-hour concentrations. Maximum 24-hour average concentration increments were estimated by assuming no haul road traffic outside the 10-hour work day. The background 24-hour PM_{10} concentration was assumed to be 50 micrograms per cubic meter (a typical PM_{10} concentration for Brawley and

Westmorland). The background 24-hour TSP concentration was assumed to be 100 micrograms per cubic meter (twice the background PM_{10} concentration). The threshold for significant visibility impairment was assumed to be a 24-hour TSP concentration above 1,000 micrograms per cubic meter.

Modeling of Spray Drift from EES Modules

Screening level dispersion modeling has been performed for a single EES module of the type considered in Alternatives 2, 3, and 4. The modeling analysis was limited to spray drift from a typical second pass module, with a receptor array extending perpendicular to the spray line arrays. Modeled receptors were spaced in rows at 300-foot intervals. Receptor rows were placed at distances of 300, 600, 1200, 2400, and 3000 feet downwind of the nearest EES facility dike. Wind speeds of 5 mph, 10 mph, 15 mph, and 20 mph were modeled, assuming neutral (D) stability for 5 mph and 10 mph winds, and slightly unstable (C) stability for stronger winds. A spray droplet size distribution covering 25 -450 microns aerodynamic diameter was used to determine a mean droplet size category of 175-200 microns. Droplet settling and deposition rates were set at 116 centimeters per second, assuming a droplet density of 1.129 grams per cubic centimeter (about 18.5% salinity).

4.4.4 No Action Alternative

Under the No Action Alternative with a continuation of current inflow conditions there would be no direct or indirect impacts on air quality conditions. Water levels would rise, inundating shoreline areas that are at most minor contributors to windblown dust.

Predicted future Salton Sea salinity levels, dissolved salt compositions, water temperatures, and saturation concentrations for major salts indicate that there would be no significant salt precipitation associated with the No Action Alternative under any of the reduced inflow scenarios. Even with Salton Sea inflows reduced to about 800,000 acre-feet per year, salinity levels at 2060 would be only about 40-45 percent of saturation concentrations.

As can be seen from Table 2.4-2, the drop in water levels would average only a few inches per year under even the lowest inflow scenario. Consequently, exposed sediments are expected to drain in concert with the reduction in Salton Sea water levels. As can be seen from a comparison of Figure 3.1-2 and Table 2.4-2, the land areas that would be exposed were dry land prior to the 1905 filling of the Salton Sea, and most of these areas also became dry land between about 1917 and 1950. There are no recognizable constraints to the revegetation of these lands. Consequently, the exposed areas are expected to revegetate to a condition similar to historical conditions and adjacent upland areas. In the absence of active surface disturbance, the wind erosion potential of these areas would be similar to the low wind erosion hazard of surrounding undisturbed lands. Consequently, the air quality impacts of lowered Salton Sea water levels would be less than significant.

Effect of No Action with Continuation of Current Inflow Conditions

No significant air quality impacts would occur under the No Action Alternative with a continuation of existing inflow conditions. The level of the Salton Sea would remain relatively constant under these conditions. Although salinity levels in the Salton Sea would continue to rise, maximum salinity levels would remain well below the saturation concentrations of major salts such as sodium chloride, magnesium chloride, sodium carbonate, sodium bicarbonate, and sodium sulfate. Thus, there would be no significant change in the nature or distribution of the limited salt deposits currently found in the immediate shoreline zone.

Effect of No Action with Reduced Inflows

If Salton Sea inflows were reduced to about 1 million acre-feet per year, the level of the Salton Sea would decline over time, exposing currently submerged areas. Salinity levels in the Salton Sea would rise, but the major dissolved chloride and sulfate salts would be unlikely to reach saturation concentrations within the next 100 years. Consequently, the decline in water levels would not be expected to produce significant new salt deposits around the shoreline of the Salton Sea. Sediments exposed by lowered water levels would generally be expected to revegetate in a manner consistent with adjacent shoreline conditions. Wind erosion of exposed shoreline areas would not be expected to significantly alter current wind erosion conditions for the Salton Sea air basin.

If Salton Sea inflows were reduced to about 800,000 acre-feet per year, the level of the Salton Sea would decline more rapidly than under the 1 million acre-foot per year inflow scenario. Salinity levels in the Salton Sea would rise noticeably. Some of the major dissolved sulfate and chloride salts might reach saturation concentrations after a period of about 50 years, resulting in precipitation of various types of salt deposits. Some of these salt deposits might be exposed by receding water levels. Deposits with significant chloride salt content generally would be resistant to wind erosion. Any salt deposits dominated by sodium sulfate or sodium bicarbonate salts might be subject to wind erosion problems. The extent to which such erodible salt deposits would be formed and exposed is uncertain. Exposed sediments unaffected by salt deposits would be expected to revegetate in a manner consistent with adjacent shoreline areas. Consequently, the potential for a significant increase in wind erosion in the Salton Sea air basin is uncertain under the 800,000 acre-foot per year inflow scenario.

4.4.5 Alternative 1

Construction of salt concentration ponds under Alternative 1 would result in significant fugitive dust and vehicle emissions during the four-year construction period. Exhaust emissions from construction vehicle traffic would significantly exceed conformity rule *de minimis* levels applicable to Imperial County. In addition, fugitive dust emissions from construction vehicle travel on unpaved haul roads would substantially exceed conformity rule *de minimis* levels. Fugitive dust emissions along haul roads and at equipment staging areas could be reduced by various dust control practices and by limiting vehicle speeds on haul roads. Paving of the haul road is considered infeasible due to the size and weight of the haul trucks that would use the road. Even with aggressive application of feasible dust control methods, fugitive dust emissions would remain substantially above conformity rule *de minimis* levels.

Preliminary dispersion modeling of fugitive PM_{10} emissions along the proposed haul road indicates that the federal 24-hour PM_{10} standard might be exceeded within 2,500 feet of the haul road during periods when daytime wind speeds average about 2 mph, and within 600 feet of the haul road when daytime wind speeds average about 7 mph. As long as the haul road alignment is kept more than 1,000 feet from State Route 86, there should be minimal potential for visibility hazards due to fugitive dust generated on the haul road. The area where the haul road crosses State Route 86 will require special attention for dust control.

Under Alternative 1, options for achieving compliance with the Clean Air Act conformity rule are limited. There are no obvious sources of emission offsets available to compensate for added ozone precursor or fugitive dust emissions. Because ozone problems in Imperial County appear to be dominated by pollutant transport rather than by in-basin ozone formation, it may be possible for the Imperial County APCD and CARB to develop an ozone SIP amendment that accounts for emissions associated with Alternative 1 without any delay to attainment of the federal ozone standard.

As noted in Chapter 3, annual average PM_{10} concentrations in the Salton Sea air basin have shown little change since 1992. The absence of any discernable trend in PM_{10} concentrations suggests that the federal PM_{10} standards will not be attained in the near future. Consequently, a four-year period of significant construction-related PM_{10} may not alter the realistic prospects for achieving the federal PM_{10} standard. Although localized violations of the federal PM_{10} standard would be expected from any significant construction project, there is limited public access to the construction site or haul road vicinity. Consequently, public exposure to high PM_{10} concentrations associated with construction of Alternative 1 would be limited. The construction work force would be the major affected population. Existing PM_{10} monitoring stations are sufficiently far from the construction area that it is unlikely that data from existing monitoring stations will demonstrate impact from project-related construction activities. It is unclear if these considerations could be used to support either a Clean Air Act conformity determination or an amendment to the PM_{10} SIP that accommodates Alternative 1.

Operation of the salt concentration ponds would have no significant air quality impacts. While the salt concentration within the ponds would become significantly greater than the salt concentration of the remainder of the Salton Sea, wave action in the ponds would be somewhat less than in the more open portions of the Salton Sea. Consequently, there would be little if any change in the overall salt content of whitecap spray generated over the Salton Sea.

Effect of Alternative 1 with Continuation of Current Inflow Conditions

Construction of salt concentration ponds under Alternative 1 would occur over a four-year period. Borrow sites, construction haul roads, equipment staging areas, and salt pond construction sites are all within the portion of Imperial County which is designated as nonattainment for two federal air quality standards: ozone and PM_{10}.

The volume of heavy truck traffic over the haul road would generate large quantities of fugitive dust emissions throughout the four-year construction period, and would require a Clean Air Act conformity review. During the four-year construction period, approximately 21.5 million cubic yards of aggregate and rip-rap material would need to be excavated from two borrow sites and transported to the concentration pond construction sites. Approximately 8 million tons of aggregate material would need to be hauled each year from the quarry site to the construction site. Assuming 250 work days per year and the use of 100-ton capacity off-road haulers, a four year construction period would require an average of 323 truck loads of aggregate each working day. Empty trucks returning to the quarry site also would use the haul road. For a 10-hour work day, this would average 65 truck trips along the road each hour. Paving of the haul road to reduce fugitive dust emissions is considered infeasible due to the size and weight of haul trucks. Sprinkler trucks used for dust control would add a few additional truck trips per hour. The two-mile haul road segment between State Highway 86 and the construction site would experience additional vehicle traffic from the construction work force and heavy equipment transporters.

Construction vehicle emissions (exhaust emissions plus fugitive dust from unpaved roads) would average 172 tons per year of reactive organic compounds, 1,885 tons per year of nitrogen oxides, and 2,738 tons per year of PM_{10}. All of these quantities exceed the conformity rule *de minimis* thresholds applicable in Imperial County (100 tons per year for reactive organic compounds, 100 tons per year for nitrogen oxides, and 100 tons per year for PM_{10}). Additional emissions would occur from operation of the quarry used for construction aggregate.

Preliminary dispersion modeling of fugitive PM_{10} emissions along the proposed haul road indicates that the federal 24-hour PM_{10} standard might be exceeded within 2,500 feet of the haul road during periods when daytime wind speeds average about 2 mph, and within 600 feet of the haul road when daytime wind speeds average about 7 mph. There is limited public access to the construction site or haul road vicinity. Consequently, public exposure to high PM_{10} concentrations associated with construction of Alternative 1 would be limited. The construction work force would be the major affected population.

An additional concern regarding fugitive dust from the haul road is the potential for visibility impairment along State Route 86. Significant visibility impairment is unlikely when total particulate matter concentrations are less than 1,000 micrograms per cubic meter. A screening level dispersion modeling analysis indicates that maximum 1-hour average total particulate matter concentrations should drop below 1,000 micrograms per cubic meter at distances of more than 650 feet from the haul road. As long as the haul road alignment is kept more than 1,000 feet from State Route 86, there should be minimal potential for visibility hazards due to fugitive dust generated on the haul road.

The area where the haul road crosses State Route 86 would require special attention for dust control.

Operation of the salt concentration ponds under Alternative 1 would require pumping of Salton Sea water into the ponds. If pumps powered by diesel engines were used, the pumps probably would require permits from the Imperial County APCD. Electrically powered pumps would avoid permit requirements and minimize air pollutant emissions.

While the salt concentration within the ponds would become significantly greater than the salt concentration of the remainder of the Salton Sea, wave action in the ponds would be less than in the more open portions of the Salton Sea. Whitecap formation and resulting salt spray generation should be less in the salt concentration ponds than in the open portions of the Salton Sea. Consequently, there would be little if any change in the overall salt content of air around the Salton Sea.

Effect of Alternative 1 with Reduced Inflows

Under the reduced inflow scenarios, construction impacts and Clean Air Act conformity issues associated with construction and operations of salt concentration ponds would be the same as discussed above. Air quality impacts associated with operation of the concentration ponds would be the same as discussed above.

4.4.6 Alternative 2

Construction of an enhanced evaporation system under Alternative 2 would result in fugitive dust and vehicle emissions during the construction period. A Clean Air Act conformity review would be required for ozone precursor emissions generated during construction activities. Because the EES is expected to require stationary source permits, operation of the EES would be excluded from separate Clean Air Act conformity reviews. Generalized screening analyses indicate the potential for significant salt drift downwind of the EES during periods of strong winds. Permit conditions for the EES would probably include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 2 with Continuation of Current Inflow Conditions

The Phase 1 system of 75 enhanced evaporation system modules would occupy approximately 5,000 acres. Additional areas would be used for access roads, pipelines, and buffer areas. About 70 percent of the system modules under Alternative 2 would be located in Imperial County, with the remaining 30 percent located in Riverside County. Construction of enhanced evaporation system facilities would require significant amounts of excavation, grading, and construction of berms around the pond modules. Material for pond levees would probably be generated on-site from excavation or grading of pond modules. Spray towers, spray lines, water supply pipelines, and pumps would have to be trucked to the site and erected or installed. The existing powerline through the proposed site would have to be relocated.

The EPA general conformity rule excludes the operational emissions of stationary sources from the conformity analysis if the stationary source is subject to new source review (NSR) or prevention of significant deterioration (PSD) permits (40 CFR 93.153(d)(1)). EPA Region 9 considers local APCD permits to be the equivalent of federal NSR or PSD permits for purposes of the general conformity rule because APCD permit regulations are included as control measures in SIPs (Moyer, 1999). Because the EES is expected to require air quality permits, operation of the system would be excluded from Clean Air Act conformity review requirements. But because stationary source permits do not regulate construction activities, construction activities for the EES are subject to the EPA general conformity rule.

Construction vehicle emissions (exhaust emissions plus fugitive dust from unpaved roads) would average 18.9 tons per year of reactive organic compounds, 295 tons per year of nitrogen oxides, and 145 tons per year of PM_{10}. These emissions would be split between areas with different nonattainment designations and different conformity rule *de minimis* thresholds. Emissions in Riverside County would be about 6.3 tons per year of reactive organic compounds, 98.3 tons per year of nitrogen oxides, and 48.2 tons per year of PM_{10}. Emissions in Imperial County would be about 12.6 tons per year of reactive organic compounds, 196.6 tons per year of nitrogen oxides, and 96.3 tons per year of PM_{10}. Estimated construction activity emissions for the portion of the EES built in Riverside County would exceed the applicable conformity rule *de minimis* threshold for nitrogen oxide emissions (25 tons per year). Estimated construction activity emissions for the portion of the EES built in Imperial County would exceed the applicable conformity rule *de minimis* threshold for nitrogen oxide emissions (100 tons per year). Consequently, construction activities associated with the EES for Alternative 2 would require a Clean Air Act conformity determination for both the Riverside County AQMA ozone nonattainment area and the Imperial County ozone nonattainment area.

Operation of the EES would result in the potential for significant salt spray drift downwind of the site. Generalized screening level analyses suggest that high drift concentrations would occur within 300-600 feet of the modules during low wind speed conditions (5 mph), within 1,200 feet of the modules under moderate wind speed conditions (10 mph), and within 1/2 mile of the modules under strong wind speed conditions (15-20 mph). If buffer areas around the system were limited, spray drift to offsite areas might exceed impact significance levels.

The EES would require air quality permits from the relevant air pollution control agency (South Coast Air Quality Management District for the Riverside County portion, and Imperial County Air Pollution Control District for the Imperial County portion). Siting of EES modules would require some caution to avoid salt drift impacts on public roadways, power lines and other utility systems, and sensitive downwind habitat areas. Predominant wind patterns at the Bombay Beach site are expected to be from the southeast, northwest, and northeast. Permit conditions probably would include restrictions on operations during periods of strong winds, and possibly minimum buffer area requirements. Other likely permit conditions would include various reporting requirements and possibly some drift monitoring studies.

Pumps used for the EES would probably be electrically powered. Any pumps run by diesel engines or generators would require permits from the appropriate local air quality management agency.

Effect of Alternative 2 with Reduced Inflows

Air quality issues for the EES under reduced inflow scenarios would be the same as discussed above. Salinity levels for the inflow to the pond modules would be somewhat higher than under the current inflow scenario, resulting in somewhat higher salt content in spray drift from the system.

4.4.7 Alternative 3

Construction of an enhanced evaporation system under Alternative 3 would result in significant fugitive dust and vehicle emissions during the construction period. A Clean Air Act conformity review would be required ozone precursor and PM_{10} emissions from construction activities. Because the EES is expected to require stationary source permits, operation of the EES would be excluded from Clean Air Act conformity reviews. Preliminary dispersion modeling indicates the potential for significant salt drift downwind of the EES during periods of strong winds. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 3 with Continuation of Current Inflow Conditions

Construction and operation of an EES under Alternative 3 would have the same types of impacts as discussed for Alternative 2. Construction vehicle emissions (exhaust emissions plus fugitive dust from unpaved roads) would average 18.9 tons per year of reactive organic compounds, 295 tons per year of nitrogen oxides, and 145 tons per year of PM_{10}. Nitrogen oxide emissions and PM_{10} emissions would exceed the relevant conformity rule *de minimis* thresholds for Imperial County (100 tons per year of nitrogen oxide emissions and 100 tons per year of PM_{10} emissions). Consequently, construction activities associated with the EES for Alternative 3 would require a Clean Air Act conformity determination for both the Imperial County ozone nonattainment area and the Imperial Valley PM_{10} nonattainment area.

Operation of the EES under Alternative 3 would pose the same kinds of salt drift impacts as discussed for Alternative 2. Because the EES would be entirely within Imperial County, all air quality permits would be obtained from the Imperial County Air Pollution Control District. Siting of EES modules would require some caution to avoid salt drift impacts on public roadways, power lines and other utility systems, and sensitive downwind habitat areas. Predominant wind direction patterns at the Navy test base site are expected to be from the northwest, west, and southeast. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 3 with Reduced Inflows

Air quality issues for the Alternative 3 EES under reduced inflow scenarios would be the same as discussed for Alternative 2. Salinity levels for the inflow to the pond modules would be somewhat higher than under the current inflow scenario, resulting in somewhat higher salt content in spray drift from the system.

4.4.8 Alternative 4

Construction of salt concentration ponds and EES modules under Alternative 4 would result in significant fugitive dust and vehicle emissions during the three-year construction period. Fugitive dust emissions from construction vehicle travel on unpaved haul roads would substantially exceed Clean Air Act *de minimis* levels, requiring a Clean Air Act conformity review. Fugitive dust emissions along haul roads and at equipment staging areas could be reduced by various dust control practices and by limiting vehicle speeds on haul roads.

Because the EES is expected to require stationary source permits, operation of the EES would be excluded from separate Clean Air Act conformity reviews. Preliminary dispersion modeling indicates the potential for significant salt drift downwind of the EES during periods of strong winds. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 4 with Continuation of Current Inflow Conditions

Construction of the northern salt concentration pond under Alternative 4 would have impacts similar to those discussed for Alternative 1. The high volume of heavy truck traffic over the haul road from the borrow sites would generate large quantities of fugitive dust emissions throughout the four year construction period. Construction of EES modules would be an additional source of fugitive dust and vehicle emissions during the construction stage. The EES for Alternative 4 would require approximately 50 modules (as compared to 75 modules for Alternative 3).

Assuming a three-year construction period, emissions would average 132 tons per year of reactive organic compounds, 1,506 tons per year of nitrogen oxides, and 1,997 tons per year of PM_{10}. All of these quantities exceed the conformity rule *de minimis* thresholds applicable in Imperial County (100 tons per year for reactive organic compounds, 100 tons per year for nitrogen oxides, and 100 tons per year for PM_{10}). Additional emissions would occur from operation of the quarry used for construction aggregate. Consequently, construction activities associated with Alternative 4 would require a Clean Air Act conformity determination for both the Imperial County ozone nonattainment area and the Imperial Valley PM_{10} nonattainment area.

Because the EES is expected to require stationary source permits, operation of the EES would be excluded from Clean Air Act conformity reviews. As noted in the discussion of Alternative 2, preliminary dispersion modeling indicates the potential for significant salt drift downwind of the EES during periods of strong winds. Siting of EES modules would require some caution to avoid salt drift impacts on public roadways, power lines and other utility systems, and sensitive downwind habitat areas. Predominant wind direction patterns at the Navy test base site are expected to be from the northwest, west, and southeast. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 4 with Reduced Inflows

Air quality issues for Alternative 4 under reduced inflow scenarios would be the same as discussed above. Salinity levels for the inflow to the EES modules would be somewhat higher than under the current inflow scenario, resulting in somewhat higher salt content in spray drift from the system.

4.4.9 Alternative 5

Construction of the southern salt concentration pond and an in-pond EES under Alternative 5 would result in significant fugitive dust and vehicle emissions during the four-year construction period. Fugitive dust emissions from construction vehicle travel on unpaved haul roads would substantially exceed Clean Air Act *de minimis* levels, requiring a Clean Air Act conformity review. Fugitive dust emissions along haul roads and at equipment staging areas could be reduced by various dust control practices and by limiting vehicle speeds on haul roads.

Because the EES for Alternative 5 is expected to require stationary source permits, operation of the EES would be excluded from Clean Air Act conformity reviews. Because of its lower spray height, the in-pond EES for Alternative 5 is expected to have significantly less potential for downwind salt drift impacts than the EES design considered for Alternatives 2, 3, and 4. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Construction of the southern salt concentration pond under Alternative 5 would have impacts similar to those discussed for Alternative 1. The high volume of heavy truck traffic over the haul road from the borrow sites would generate large quantities of fugitive dust emissions throughout the four year construction period. Installation of EES equipment would require less site disturbance than the EES modules for Alternatives 2, 3, and 4.

Assuming a three-year construction period, emissions would average 111 tons per year of reactive organic compounds, 1,217 tons per year of nitrogen oxides, and 1,769 tons per year of PM_{10}. All of these quantities exceed the conformity rule *de minimis* thresholds applicable in Imperial County (100 tons per year for reactive organic compounds, 100 tons per year for nitrogen oxides, and 100 tons per year for PM_{10}). Additional emissions would occur from operation of the quarry used for construction aggregate. Consequently, construction activities associated with Alternative 5 would require a Clean Air Act conformity determination for both the Imperial County ozone nonattainment area and the Imperial Valley PM_{10} nonattainment area.

Because the EES is expected to require stationary source permits, operation of the EES would be excluded from Clean Air Act conformity reviews. Maximum spray droplet height for the in-pond EES proposed under Alternative 5 would be substantially less than the spray release heights for the EES considered in Alternatives 2, 3, and 4. Consequently, Alternative 5 would have a lower potential for off-site salt drift impacts than the other EES alternatives. Permit conditions for the EES probably would include restrictions on system operation during high winds, minimum buffer area requirement, and various reporting or monitoring requirements.

Effect of Alternative 5 with Reduced Inflows

Air quality issues for Alternative 5 under reduced inflow scenarios would be the same as discussed above. Salinity levels for the inflow to the EES modules would be somewhat higher than under the current inflow scenario, resulting in somewhat higher salt content in spray drift from the system.

4.4.10 Cumulative Effects

The various cumulative projects identified in Chapter 2 are primarily water management and habitat improvement projects or programs that have few direct air quality impacts. Water management programs will have some effect on water levels and salinity levels in the Salton Sea, but these effects will be within the range of conditions considered under the three generalized inflow scenarios.

The Mesquite Regional Landfill project discussed in Section 2.11.12 would have minor cumulative air quality impacts on the Salton Sea Air Basin from train operations and landfill management practices. Although the rail line runs near the EES site for Alternative 2, emissions from a few trains per day would not have any measurable effect on ambient air quality at the EES site. The expansion of the Mesquite Gold Mine (discussed in Section 2.11.14) would have some additional minor cumulative air quality impacts on the Salton Sea Air Basin. Both of these projects, however, are sufficiently separated from the Salton Sea restoration project alternatives to avoid any measurable cumulative impacts at the restoration project sites.

4.4.11 Mitigation Measures

Alternative 1

Develop and implement a dust control plan for construction haul roads and construction equipment staging areas. The dust control plan should be coordinated with the Imperial County Air Pollution Control District. Components of the dust control plan might include measures such as frequent sprinkling or application of other dust suppressants on construction haul roads and equipment staging area; controlling vehicle speeds on construction haul roads; and sprinkling soil stockpiles to minimize wind erosion.

Except where road crossings are required, keep haul road alignments at least 1,000 feet away from public highways. Haul road alignments should be kept at least 1,000 feet away from public highways to avoid potential visibility problems associated with fugitive dust generated by haul road traffic. Locations where haul roads must cross other roadways should receive special attention in terms of dust control activities.

Use electrically powered pumps instead of diesel-fueled pumps for facility operations. Wherever possible, electrically powered pumps should be used in preference to pumps powered by diesel engines or generators.

Coordinate with the Imperial County APCD, CARB, and EPA Region 9 to identify elements of ozone and PM_{10} SIP amendments that would accommodate construction of the selected alternative. Approval of Alternative 1 would require a demonstration of conformity for both ozone precursor and PM_{10} emissions. The most practical method for demonstrating conformity appears to be the development of SIP amendments that explicitly account for Alternative 1 while meeting EPA requirements and attainment deadlines.

Alternative 2

Develop and implement a dust control plan for construction haul roads and construction equipment staging areas. The dust control plan should be coordinated with the Imperial County Air Pollution Control District and the South Coast Air Quality Management District. Components of the dust control plan might include measures such as frequent sprinkling or application of other dust suppressants on construction haul roads and equipment staging area; controlling vehicle speeds on construction haul roads; and sprinkling soil stockpiles to minimize wind erosion.

Site EES modules and incorporate buffer zones around the EES to reduce potential public exposure to salt drift and to minimize salt drift impacts on surrounding land uses, public roadways, and biologically sensitive areas. Permit applications for EES modules will probably require some dispersion modeling studies to identify buffer zone requirements and site layout options for minimizing off-site salt drift.

Use automated controls to shut down some or all EES modules when hourly average wind speeds exceed 14-16 mph. Restrictions on the operation of EES modules during periods of strong winds will probably be included in air quality permits for the system.

Use electrically powered pumps instead of diesel-fueled pumps for facility operations. Wherever possible, electrically powered pumps should be used in preference to pumps powered by diesel engines or generators.

Coordinate with the Imperial County APCD, South Coast AQMD, CARB, and EPA Region 9 to identify elements of ozone and PM_{10} SIP amendments that would accommodate construction of the selected alternative. Approval of Alternative 2 would require a demonstration of conformity for ozone precursor emissions in Riverside and Imperial counties. The most practical method for demonstrating conformity appears to be the development of SIP amendments that explicitly account for Alternative 2 while meeting EPA requirements and attainment deadlines.

Alternative 3

Develop and implement a dust control plan for construction haul roads and construction equipment staging areas. The dust control plan should be coordinated with the Imperial County Air Pollution Control District. Components of the dust control plan might include measures such as frequent sprinkling or application of other dust suppressants on construction haul roads and equipment staging area; controlling vehicle speeds on construction haul roads; and sprinkling soil stockpiles to minimize wind erosion.

Site EES modules and incorporate buffer zones around the EES to reduce potential public exposure to salt drift and to minimize salt drift impacts on surrounding land uses, public roadways, and biologically sensitive areas. Permit applications for EES modules will probably require some dispersion modeling studies to identify buffer zone requirements and site layout options for minimizing off-site salt drift.

Use automated controls to shut down some or all EES modules when hourly average wind speeds exceed 14-16 mph. Restrictions on the operation of EES modules during periods of strong winds will probably be included in air quality permits for the system.

Use electrically powered pumps instead of diesel-fueled pumps for facility operations. Wherever possible, electrically powered pumps should be used in preference to pumps powered by diesel engines or generators.

Coordinate with the Imperial County APCD, CARB, and EPA Region 9 to identify elements of ozone and PM_{10} SIP amendments that would accommodate construction of the selected alternative. Approval of Alternative 3 would require a demonstration of conformity for both ozone precursor and PM_{10} emissions in Imperial County. The most practical method for demonstrating conformity appears to be the development of SIP amendments that explicitly account for Alternative 3 while meeting EPA requirements and attainment deadlines.

Alternative 4

Develop and implement a dust control plan for construction haul roads and construction equipment staging areas. The dust control plan should be coordinated with the Imperial County Air Pollution Control District. Components of the dust control plan might include measures such as frequent sprinkling or application of other dust suppressants on construction haul roads and equipment staging area; controlling vehicle speeds on construction haul roads; and sprinkling soil stockpiles to minimize wind erosion.

Site EES modules and incorporate buffer zones around the EES to reduce potential public exposure to salt drift and to minimize salt drift impacts on surrounding land uses, public roadways, and biologically sensitive areas. Permit applications for EES modules will probably require some dispersion modeling studies to identify buffer zone requirements and site layout options for minimizing off-site salt drift.

Use automated controls to shut down some or all EES modules when hourly average wind speeds exceed 14-16 mph. Restrictions on the operation of EES modules during periods of strong winds will probably be included in air quality permits for the system.

Use electrically powered pumps instead of diesel-fueled pumps for facility operations. Wherever possible, electrically powered pumps should be used in preference to pumps powered by diesel engines or generators.

Coordinate with the Imperial County APCD, CARB, and EPA Region 9 to identify elements of ozone and PM_{10} SIP amendments that would accommodate construction of the selected alternative. Approval of Alternative 4 would require a demonstration of conformity for both ozone precursor and PM_{10} emissions in Imperial County. The most practical method for demonstrating conformity appears to be the development of SIP amendments that explicitly account for Alternative 4 while meeting EPA requirements and attainment deadlines.

Alternative 5

Develop and implement a dust control plan for construction haul roads and construction equipment staging areas. The dust control plan should be coordinated with the Imperial County Air Pollution Control District. Components of the dust control plan might include measures such as frequent sprinkling or application of other dust suppressants on construction haul roads and equipment staging area; controlling vehicle speeds on construction haul roads; and sprinkling soil stockpiles to minimize wind erosion.

Use automated controls to shut down some or all EES equipment during periods of strong winds. Restrictions on the operation of EES modules during periods of strong winds will probably be included in air quality permits for the system. The maximum wind speed allowed for EES operation might be higher for Alternative 5 than for the other EES designs.

Use electrically powered pumps instead of diesel-fueled pumps for facility operations. Wherever possible, electrically powered pumps should be used in preference to pumps powered by diesel engines or generators.

Coordinate with the Imperial County APCD, CARB, and EPA Region 9 to identify elements of ozone and PM_{10} SIP amendments that would accommodate construction of the selected alternative. Approval of Alternative 5 would require a demonstration of conformity for both ozone precursor and PM_{10} emissions in Imperial County. The most practical method for demonstrating conformity appears to be the development of SIP amendments that explicitly account for Alternative 5 while meeting EPA requirements and attainment deadlines.

4.4.12 Potentially Significant Unavoidable Impacts

Potentially significant air quality impacts would occur from ozone precursor and fugitive dust emissions during construction of Alternatives 1, 3, 4, or 5. Alternative 2 would have significant ozone precursor emissions during the construction stage. There does not appear to be any feasible way to reduced construction-related fugitive dust emissions to a less than significant level. As presently written, the EPA general conformity rule would preclude adoption of any of these alternatives unless state and local agencies can prepare a PM_{10} SIP amendment that accounts for the selected alternative while still meeting Clean Air Act deadlines and requirements.

4.5 NOISE

4.5.1 Summary of Environmental Consequences

The primary sources of noise under the phase one actions relate to construction activities. Construction-related noise impacts would be temporary and intermittent and would not be significant. While not significant, limiting use of heavy construction equipment and outdoor power tools to normal daylight hours (7 AM to 7 PM) would lessen the effects of construction noise on sensitive land uses. Limiting use of equipment to certain days of the week or seasons of the year could further lesson the effects of construction noise in recreational areas during peak use times. No significant operational noise impacts have been identified for any of the alternatives.

4.5.2 Significance Criteria

Annoyance effects are a primary consideration for most noise impact assessments. Because the reaction to noise level changes involves both physiological and psychological factors, the magnitude of a noise level change can be as important as the resulting overall noise level. A readily noticeable increase in noise levels often will be considered a significant effect by local residents even if the overall noise level is still within land use compatibility guidelines. On the other hand, noise level increases that are not noticeable to most people generally are not considered a significant change, even if the overall noise level is close to or somewhat above land use compatibility guidelines.

A variety of factors related to the nature of a noise source also can affect people's reaction to it. Most people find evening and nighttime noise the most objectionable and are more willing to accept noise sources that operate only during daytime hours. Similarly, temporary noise sources generally are tolerated more than permanent noise sources. Depending on the repetition pattern, intermittent noise sources can be either more or less objectionable than continuous noise sources.

A proposed action can have noise impacts through two different mechanisms: creating new sources of noise in an area or establishing noise-sensitive land uses in locations that will be exposed to high noise levels. Only the former is a concern for this action because no new noise-sensitive land uses are proposed. In this analysis, an alternative would have significant noise impacts if its implementation would directly or indirectly increase ambient CNEL levels by a discernable increment (3 dB or more) at noise-sensitive land uses, while resulting in an overall noise level beyond the relevant "normally acceptable" level (a CNEL of 60 dBA in Imperial and Riverside counties as presented in their respective general plan noise elements).

Temporary noise sources in developed or urbanized areas that are restricted to daytime hours, such as most construction and demolition activities, would be considered a significant impact only if they affect noise-sensitive land uses and result in CNEL levels more than 10 dB above the "normally acceptable" land use compatibility criterion (60 dBA) for the affected noise-sensitive land use.

4.5.3 Assessment Methods

The environmental consequences section evaluates the noise effects of the no action and phase one alternatives. For the action alternatives, typical noise levels are presented in tabular format to describe noise levels at different distances from the noise sources. Locations of the noise sources are identified, and the distances from the noise sources to sensitive land uses are provided. Noise levels have been compared to noise criteria for the different areas (noise criteria are presented in Section 3.5), and a determination of significance has been made. While no significant noise impacts have been identified, mitigation to further reduce noise levels is provided.

4.5.4 No Action Alternative

Effect of No Action Alternative with Continuation of Current Inflow Conditions

The No Action Alternative would have no direct noise effects under current inflow conditions. No new noise sources would be introduced, and no increases in noise levels would occur. The No Action Alternative under current inflow conditions could result in a minor indirect decrease in noise levels if the condition of the sea continued to degrade and vehicle traffic to the Sea and watercraft use on the Sea decreased.

Effect of No Action Alternative with Reduced Inflows

The No Action Alternative would have no direct noise effects under reduced inflow conditions. No new noise sources would be introduced, and no increases in noise levels would occur. The No Action Alternative under reduced inflow conditions could result in a minor indirect decrease in noise levels if the condition of the Sea continued to degrade and vehicle traffic to the sea and watercraft use on the Sea decreased.

4.5.5 Alternative 1

Alternative 1 would not have any significant noise impacts under current or reduced flow conditions.

4.5.6 Alternative 2

Alternative 2 would not result in significant adverse noise effects under current or reduced inflow conditions.

4.5.7 Alternative 3

Alternative 3 would not result in significant adverse noise effects.

4.5.8 Alternative 4

Alternative 4 would not result in significant adverse noise effects.

4.5.9 Alternative 5

Alternative 5 may result in significant but mitigable adverse noise effects.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Alternative 5 combines the north evaporation pond proposed in Alternative 1 with an EES incorporated within the pond itself. Instead of the EES tower configuration described in Alternative 1, the EES used in this alternative would involve technology typically used in artificial snowmaking. This method would employ approximately 3,000 portable, ground-based blowers that would use compressed air to spray piped Salton Sea water up into the air rather than dropping it from towers.

Construction-related noise effects and operational-related noise effects would be similar to those described for Alternative 1. These actions would not generate high levels of noise; therefore, no significant construction-related noise impacts would occur.

The operation of EES equipment could result in significant noise impacts to Salton City residents and recreationists on the Sea depending upon the size, placement, and operational cycles of the blowers. For instance, siting blowers in a high concentration along the dike on the western side of the evaporation pond would have greater noise impacts than placing blowers in a more dispersed pattern farther away from the residences located along the western shore. In addition, running the blowers during certain times of the day (e.g., nighttime hours) or in certain cycles (e.g., having the blowers continuously cycle on and off) may result in annoyance effects in excess to just the noise levels created.

As described under Alternative 1, limiting use of heavy construction equipment to normal daylight hours (7 AM to 7 PM) would lessen the effects of construction-related noise. Likewise, limiting the times of EES blower use (i.e., placing restriction on the hours of day, days of week, or times of year that blowers operate) and configuring the blowers away from the most sensitive land uses would lessen the effects of operational noise.

Effect of Alternative 5 with Reduced Inflow Conditions

Noise effects from constructing the concentration pond and EES under reduced inflow conditions would be similar to those described under current inflow conditions. An increase or decrease in the amount of construction and the amount of water processed would have slightly greater or slightly fewer noise effects. The closer proximity to Salton City could have slightly higher noise effects when compared to Alternative 1.

4.5.10 Cumulative Effects

No direct cumulative noise effects would result from regional projects. Minor indirect cumulative noise effects could occur if the desirability of the Salton Sea were to increase or decrease, resulting in an increase or decrease in vehicle traffic on area roadways and watercraft traffic on the sea and a concurrent increase or decrease in traffic- and watercraft-related noise levels.

4.5.11 Mitigation Measures

No mitigation measures for all alternatives except Alternative 5 are required because no significant impacts have been identified for these alternatives; however, suggestions to lessen the effects of temporary construction noise are provided.

Limit construction activity to lessen effects of construction noise. Limit the use of heavy construction equipment and outdoor power tools to normal daylight hours (7 AM to 7 PM) to reduce the effects of construction noise on sensitive land uses. Limit use of equipment to certain days of the week or seasons of the year to further lessen the effects of construction noise in recreational areas during peak use times.

Limit use of EES equipment and configure equipment to reduce noise impacts. For Alternative 5, limit the times of EES blower use (i.e., placing restriction on the hours of day, days of week, or times of year that blowers operate) and configure the blowers away from the most sensitive land uses to lessen the effects of operational noise.

4.5.12 Potentially Significant Unavoidable Impacts

No potentially significant unavoidable noise impacts have been identified.

4.6 FISHERIES AND AQUATIC RESOURCES

4.6.1 Summary of Environmental Consequences

The No Action Alternative for both current inflow and reduced inflow conditions would result in significant and unmitigable fisheries and aquatic resource impacts. Alternatives 1-5 would provide long-term beneficial effects for fisheries and aquatic resources due to the decrease in salinity and the control of elevation, compared to the No Action Alternative conditions. Significant and mitigable short-term adverse impacts would occur under alternatives 1 through 5 as a result of changes in habitat and incompatibilities between restoration (construction) activities and existing fisheries and aquatic resources. Four common actions would be implemented under Action Alternatives 1-5, and would result in net benefits. Chapter 5 provides an analysis of these common actions.

4.6.2 Significance Criteria

Criteria used to evaluate the significance of impacts to fisheries and aquatic resources are derived from the legal (federal and state) requirements to protect special status species and sensitive habitats, as described in Chapter 3. Specific criteria also take into account issues identified during public scoping of the EIS/EIR, discussions with USFWS and CDFG, issues from other reports addressing potential impacts of various land uses at Salton Sea on fisheries and aquatic resources, federal and state laws on fisheries and aquatic resources, including the Endangered Species Act and Clean Water Act.

An alternative could have a significant fisheries and aquatic resources impact if its implementation would result in any of the following:

- Harm to, harassment of, or destruction of individuals of any fish or aquatic species listed as endangered, threatened, or rare under federal or California law. In addition, such impacts are considered significant to other fish species under the following conditions:
  - survival and reproduction of a species in the wild are in immediate jeopardy;
  - the species exists in such small numbers throughout all of or a significant portion of its range that it may become endangered if its environment worsens due to the project; or
  - the species is likely to become endangered in the foreseeable future and may be categorized as threatened under federal law.
- Modification or destruction of the habitat, migration use corridors, or breeding areas of endangered, threatened, rare, or other fish or aquatic species, as defined in the preceding paragraphs.
- Loss of a substantial number of any fish or aquatic species that could affect abundance or diversity of that species beyond normal variability.

- Impacts to sensitive species.

4.6.3 Assessment Methods

Potential impacts to fisheries and aquatic resources are assessed by comparing proposed changes in habitat use under each of the alternatives to current and planned uses of these same areas. Existing fisheries and aquatic resources status, as described in Chapter 3, form the basis for assessing the significance of changes to fisheries and aquatic resources under each of the alternatives.

Salinity and Sea elevation are recognized as the primary controlling factors determining which aquatic species can survive and thrive at a given point in time. Salinity concentration can directly impact the reproduction and survivability of aquatic species while salinity and elevation can indirectly affect species by altering the temperature and water chemistry of the Sea. Thus, thresholds of different species to salinity were compared to the forecasted changes in salinity for each alternative. Similarly, potential changes in elevation and salinity, on temperature and water chemistry were qualitatively assessed. The following provides the data used to assess impacts from salinity on aquatic species and data used to assess effects from changes in salinity and elevation on temperature and water chemistry.

Salinity Impact Assessment Method

Increasing salinity affects the physiology of organisms within the Sea. This effect can be both direct, as in when it affects the performance of specific metabolic processes, or indirect, as in when it affects the energetics of the living organism so that more energy is devoted to osmoregulation and less for fundamental processes, such as growth and reproduction. At higher salinities, species would become increasingly susceptible to other physical factors (i.e., lower oxygen levels and temperature extremes), to other biological factors (disease and predators), and to increased mortality and reduced reproduction. Eventually, an increase in salinity would cause a population to crash. The result of increasing salinity in the Salton Sea would most likely be a reduction in the Salton Sea biota diversity.

Changes in the water chemistry of the Salton Sea occur from changes in solubility as salinity increases, and from changes in the biological community, which cause secondary effects on the water chemistry. The amount of oxygen dissolved in water has important biological consequences and is inversely proportional to the salinity. At one atmosphere of pressure, water temperature of 10°C, and salinity of 41,600 mg/L, oxygen saturation is 8.84. Under the same temperature and pressure but a salinity of 63,600 mg/L, oxygen saturation is reduced to 7.77, and at a salinity of 110,000 mg/L it is 5.95 (Sherwood et al. 1992). Changes in the water chemistry and subsequent changes in biological communities of the Sea would have considerable effects on fisheries.

For all organisms, the tolerable salinity range is not a plateau that drops off precipitously but a slope where stress is gradually placed on the organism, and its response represents the cumulative stress not only of salinity but of changing food supplies, temperature, ionic composition, and toxins. The greater the cumulative stress, the steeper the slope. It should be noted that the majority of Salton Sea salinity tolerance research was reported in units of parts per thousand (ppt). In order to be consistent with the other sections of this report and compare tolerances with modeled salinity level predictions, all ppt values were converted into mg/L.

Information on salinity tolerances of various types of organisms within the Salton Sea is reported below.

Phytoplankton and Phytobenthos

As water surface elevation declines and the Sea becomes shallower, it becomes progressively easier for wind energy to mix the water column. This could transport oxygen to deeper layers of the water column and in some areas to the bottom. During the summer, 60 to 100 percent of the Sea bottom is exposed to dissolved oxygen concentrations of <1 mg/L (Hurlbert 1999a). Increased ease in mixing could facilitate suspension of materials present in bottom sediment, which could result in increased oxygen demands for suspended organic material. Increased ease of wind mixing results in increases in local current velocities and the ability for plankton and suspended substances to be transported. This could increase the rate of movement of phytoplankton in the Salton Sea, speeding up the effects of blooms of toxic algae. Decreased water depth may allow greater suspension of bottom materials that would increase turbidity and could increase the rate of mobilization for sediment-derived nutrients, such as nitrogen and phosphorus, and further accelerate eutrophication.

Recently, several potentially toxic algae species have been found in the Salton Sea. Certain species have been documented recently that were not known to occur previously and that are potentially responsible for the fish die-offs (Hurlbert 1999b). As many of these are marine species, increases in salinity may allow them to expand their numbers. These include *Chatonella* cf. *marina*, a toxic marine alga now present in winter, *Heterocapsa niei*, a potentially toxic dinoflagellate that is often a dominant species, a Pfiesteria-like organism found in 1997, and *Gyrodinium uncatenum* and several species of *Gymnodinium* that may be capable of toxin production (Dexter et al. 1999). *Prymnesium*, a toxic alga was present in lab studies at a salinity of 50,300 to 60,200 mg/L and may become more common at higher salinities in the Salton Sea (Stephens 1999b). Continuing studies on algae are being conducted as part of the ongoing limnological studies being conducted at the Salton Sea (Hurlbert 1999c; Stephens 1999b).

Invertebrates

The literature on salinity tolerances of rotifer *Brachionus plicatilis* is inconclusive, but it has been noted that it requires acclimatization to tolerate salinities over 36,200 mg/L (Salton Sea Science Subcommittee 1998), and reproduction is generally higher at lower salinities, generally between 36,200 and 47,000 mg/L (Lubzens et al. 1985). High salinity and higher temperatures make the production of males less likely and inhibit the hatching of resting eggs (Hino and Hirano 1984; Lubzens et al. 1980, 1985, 1993).

The copepods *Apocyclops dengizicus* and *Cletocamptus dietersi* have been studied for salinity tolerances. *Apocyclops dengizicus* has been noted to survive in salinities up to 80,600 mg/L

(Timms 1993). Dexter (1993) induced reproduction at up to 72,600 mg/L, and adults survived at salinities over 85,200 mg/L for up to 120 days, but population growth stopped at over 60,200 mg/L. *Cletocamptus dietersi* was cultured at salinities up to 86,400 mg/L. Larvae died at 92,200 mg/L though adults survived and copulated at 118,400 mg/L (Dexter 1995).

The pileworm *Neanthes succinea* has been reported to have a 50 percent reduced survivorship at 69,200 mg/L, a more substantial reduction at 74,900 mg/L, and no survival at 92,200 mg/L (Kuhl and Oglesby 1979). Reproduction is hampered at salinities over 52,500 mg/L. The barnacle *Balanus amphitrite saltonensis* has loss of larval survival at 86,400 mg/L and loss of 50 percent at 58,000 mg/L (Crisp and Costlow 1963; Perez 1994). Survivorship over four weeks was not significantly affected at salinities up to 74,900 mg/L (Perez 1994). However, detrimental physiological changes were noted to occur at salinities over 50,300 mg/L (Simpson 1994). The amphipod *Gammarus mucronatus* has been noted to occur in salinities up to 52,500 mg/L (Hedgpeth 1967) and in culture at 85,200 mg/L (Salton Sea Science Subcommittee 1998). The corixid *Trichocorixa reticulata* has an extremely high tolerance for hypersaline conditions, as noted by Jang and Tullis (1980) and Euliss et al. (1991). It has been noted to occur at salinities up to 110,000 mg/L or more.

Brine shrimp are present in saline water from about 30,000 mg/L to near saturation (Hammer 1986). However, in the Great Salt Lake, shrimp cysts have been found to lose buoyancy and their populations decline at salinities of less than about 60,000 mg/L (Stephens 1990 and 1998). Conte et al. (1972, 1973) found *nauplii* did poorly at salinities of greater than 175,000 mg/L. Brine shrimp are not tolerant of high concentrations of potassium salts (Hammer and Parker 1984), and toxicity depends on the molar ratios of sodium to potassium being less than about 12 (Bowen and Carl 1992). Some of the Brinefly larvae are highly tolerant of high salinity. Brinefly larvae occur and reproduce in the north arm of Great Salt Lake at a salinity of 330,000 mg/L, but numbers are fewer than in the less saline south arm of the lake (Post 1977).

Fish Species

In general, adult fish are capable of tolerating higher salinity levels than the egg and larval life stages. Consequently, some aspects of fish life cycle may require habitats with lower salinities than are required for adult survival. Salinity measurements and predictions within the Sea have been based on the average salinity level. Although the average salinity may rise to levels exceeding fish tolerances, lower salinity areas may still be available (i.e. near drainage inflows). As a result, instances where salinity levels exceed fish tolerances the amount of suitable habitat would be severely limited, but may not preclude the species from survival within the Sea. Rather, it may concentrate populations and spawning activities to within these lower salinity areas. For the purposes of this section impacts have been determined based on the premise that when average salinity levels exceed the tolerance for species life cycle completion the species will be severely impacted. Information from the literature on the salinity tolerances of fish (and invertebrates) within the Salton Sea are provided below and are summarized in Table 4.6-1.

Tilapia. The Salton Sea tilapia population is basically a strain of *Oreochromis mossambicus* (Costa-Pierce and Doyle 1997). Tilapia have been observed to adapt successfully to gradually increasing salinity levels (pers. com. Costa-Pierce 1999). Whitfield and Blaber (1979) stated that tilapia had been collected within salinities up to 134,400 mg/L. Potts et al. (1967) established that five to ten week old fish can tolerate 74,900 mg/L indefinitely. Popper and Lichatowich (1975) reported that at salinities up to 51,400 mg/L, it was necessary to introduce predators for population control. Other research suggests the salinity range of tilapia does not exceed 74,900 mg/L, and their reproductive capabilities may be lost at 63,600 mg/L (Pullin et al. 1982). Frequent spawning activity in the Salton Sea have been observed for salinities of 43,000 – 55,000 mg/L (Costa-Pierce in prep). Research conducted in support of the CEQA/NEPA process (1998) suggests that by 63,600 mg/L the salinity tolerance of tilapia has probably been exceeded. For the purposes this report the upper salinity tolerance level for tilapia life cycle completion was established at approximately 63,600 mg/L.

There is a small amount of information on the interaction for tilapia between salinity and organic chemicals. Dange (1986) found that *O. mossambicus* is more susceptible to disruption of gill osmoregulatory mechanisms by toluene and naphthalene at 36,200 mg/L than at 20,400 mg/L. It could be inferred that higher salinities would make this species even more vulnerable to organic pollutants.

Bairdiella. Bairdiella in the Sea have a high level of developmental deformities (Whitney 1961; Matsui et al. 1992). It is thought that the deformities are, in fact, a result of a genetic founder effect. If this is so, then the ability of the bairdiella population to adapt to rising salinity may be genetically limited.

Several studies have been conducted on the effects of salinity on bairdiella. Hanson (1970) reported that juvenile bairdiella tolerated 55,300 mg/L, although there was 60 percent mortality at 58,000 mg/L. He found that mortality of yearling bairdiella began at 55,300 mg/L (40 percent) and increased to 60 percent at 58,000 mg/L and 93.3 percent at 66,400 mg/L, until no fish survived at 80,600 mg/L. Lasker et al. (1972) detected a marked increase in egg and larval mortality at salinities over 47,000 mg/L. May (1975a, 1975b, 1976) found that no larvae survived longer than two days in artificial Salton Sea water of 36,200 and 47,000 mg/L. Salinity and temperature effects on bairdiella reproduction studied by May (1975a, 1976) indicate diminished reproductive success at 41,600 mg/L and above.

Table 4.6-1
Summary of Salinity (mg/L) Occurrence and Tolerance Data for Species Inhabiting the Salton Sea

Species	Collection	Life Stage Survival	Life Cycle Completion	Population Maintenance
Brachionus plicatilis (rotifer)	81,800	52,500	50,300–52,500	41,600
Apocyclops dengizicus (copepod)	80,600	85,200	72,600	53,600
Cletocamptus dietersi (copepod)	44,000[1]	118,400	86,400	86,400
Balanus amphitrite saltonensis (barnacle)	44,000[1]	74,900	74,900	52,500

Neanthes succinea (pileworm)	44,000[1]	72,100	52,500	86,400
Gammarus mucronatus (amphipod)	52,500	85,200	--	--
Trichocorixa reticulata (water boatman)	240,000	110,00	--	--
Cynoscion xanthulus (orange-mouth corvina)	44,000[1]	60,800	41,600[2]	--
Bairdiella icistia (gulf croaker)	44,000[1]	58,000	58,000	--
Anisotremus davidsonii (sargo)	44,000[1]	58,000	47,000	--
Oreochromis mossambicus (tilapia)	134,400	74,900	63,600[3]	--
Cyprinodon macularius (desert pupfish)	98,100	74,900	74,900	--
Poecilia latipinna (sailfin molly)	94,600	92,200	--[4]	--
Gillichthys mirabilis (longjaw mudsucker)	89,300	--	80,600	--

Source: Adapted from Salton Sea Science Subcommittee 1998 DRAFT

Explanation of columns:

- **Collection**. Refers to the salinity at a site where an organism was collected in nature.
- **Life Stage Survival**. The maximum salinity, in experimental work, at which one or more life stages of a species can survive for an extended time, but where completion of the entire life cycle has not been established.
- **Life Cycle Completion**. The maximum salinity, in experimental work, at which completion of a species' entire life cycle has been demonstrated. This salinity theoretically should always be lower than the life stage survival salinity.
- **Population Maintenance**. The maximum salinity, in experimental work, at which population growth has been demonstrated and theoretically should be lower than the life cycle and life stage salinity values.

Notes:
[1] = Based on current conditions of Salton Sea
[2] = Juvenile Corvina have been observed under current conditions 44,000 mg/L. This may indicate either a higher salinity tolerance than previously recorded or successful reproduction is occurring in areas with lower salinity levels.
[3] = This is a conservative estimate. Tilapia have been found to successfully adapt to gradually increasing salinity levels and may be able to complete their life cycles at salinities higher than 63,600 (pers. comm. Costa-Pierce 1999).
[4] = Data not available

Ichthyoplankton field data collected between 1987 and 1989, with salinities ranging from 39,400 to 45,900 mg/L, respectively, showed a significant increase in the number of late larval stages but a decrease in the number of eggs and early larvae with each progressive year (Matsui et al. 1991b).

Sargo. Several studies were conducted to determine the effects of salinity on sargo. Lasker et al. (1972) showed a clear increase in larval mortality at 41,600 mg/L and higher. Hanson (1970) showed that survivorship of juvenile sargo appeared to decline markedly at salinities between 44,300 to 49,800 mg/L, reaching zero at 66,400 mg/L.

Matsui et al. (1991a) concentrated Salton Sea water by reverse osmosis and were able to acclimate adult sargo to 58,000 mg/L over a five month period. However, no spawning occurred in tanks at 52,500 or 58,000 mg/L. Brocksen and Cole (1972) reported "rather severe stress" at 47,000 mg/L.

Results of laboratory salinity tolerance tests indicated that although sargo acclimated to treatment salinities of 47,000 mg/L, significant larval mortality occurred in salinities above 41,600 mg/L, and 100 percent mortality occurred at 58,000 mg/L (Matsui et al. 1991a).

Field data collected between 1987 and 1989 with salinities of 39,400 and 45,900 mg/L, respectively, showed a decrease in both the number of late egg and early larval stages for sargo (Matsui et al. 1991a).

Orange-mouth Corvina. Although corvina is the most sought after game fish in the Salton Sea, its large size makes it a more difficult experimental organism, and it has therefore received the least amount of study. Hanson (1970) reported that corvina survived at55,300 mg/L but that mortality was complete at 65,800 mg/L.

Brocksen and Cole (1972) found that assimilation efficiency was higher at 38,400 mg/L than at 47,000 mg/L and that oxygen consumption increased as salinity increased.

Matsui, Lattin et al. (1991a) found that corvina were able to grow in Salton Sea water concentrated by reverse osmosis at salinities up to 58,000 mg/L. However, spawning could only be induced (with the aid of hormone injections) at 36,200 and 41,600 mg/L; spawning did not occur at 47,000 mg/L under their experimental conditions. The salinity level currently in the sea (44,000 mg/L) may be within the life cycle completion tolerance level for corvina, however, studies have not confirmed this.

Desert Pupfish. Desert pupfish have a high tolerance for extreme environmental conditions, including temperature, dissolved oxygen, and salinity. Barlow (1958) reported that the desert pupfish survived salinity as high as 98,100 mg/L in the laboratory and reported finding them in pools near the Salton Sea with salinities of up to 69,200 mg/L. Schoenherr (1992) reports adult pupfish tolerating water up to 74,900 mg/L. Pupfish growth is faster at 36,200 and 15,200 mg/L than in 58,000 mg/L ocean water concentrated by evaporation (Kinne 1960). Desert pupfish eggs successfully developed in salinities of 74,900 mg/L at temperatures below 33°C, with longer development times and higher mortality than at lower salinities. Development was not successful at 92,200 mg/L.

The critical thermal maximum of 44°C for this species is the highest ever recorded for a species of fish. This ability to tolerate hot water also enables them to live in hot springs. In such a habitat, the desert pupfish may feed on blue-green algae that live in water hotter than its critical thermal maximum. The pupfish does this by hovering in water as hot as it can tolerate and then darting into the hotter water for a quick bite of food. The desert pupfish also has recorded the lowest tolerated minimum for dissolved oxygen, at 0.13 mg/L.

Sailfin Molly. In general this species is considered extremely tolerant of salinity ranges (Herbert et al. 1987). Adults are reported to withstand salinities greater than 86,400 mg/L (Nordlie et al. 1992; Herre 1929). The sailfin molly has been found to occur at 94,600 mg/L but is absent from ponds at 102,800 mg/L (Herre 1929). By acclimating mollies very gradually to ocean water supplemented with salts, Nordlie et al. (1992) obtained 95.7 percent survivorship (over two weeks) at 86,400 mg/L and 43.1 percent at 92,200 mg/L.

Longjaw Mudsucker. The longjaw mudsucker has been collected from sites with salinities as high as 82,500 mg/L (Barlow 1963). Lonzarich and Smith (1997) have seen reproduction at salinities up to 80,600 mg/L.

Water Chemistry and Elevation Impact Assessment Method

A matrix was developed to qualitatively assess changes in the water chemistry, biology, and use of the Salton Sea resulting from increased salinity and decreased depth (Table 4.6-2). Forecasted changes from each alternative were compared to the matrix to determine the likely impacts.

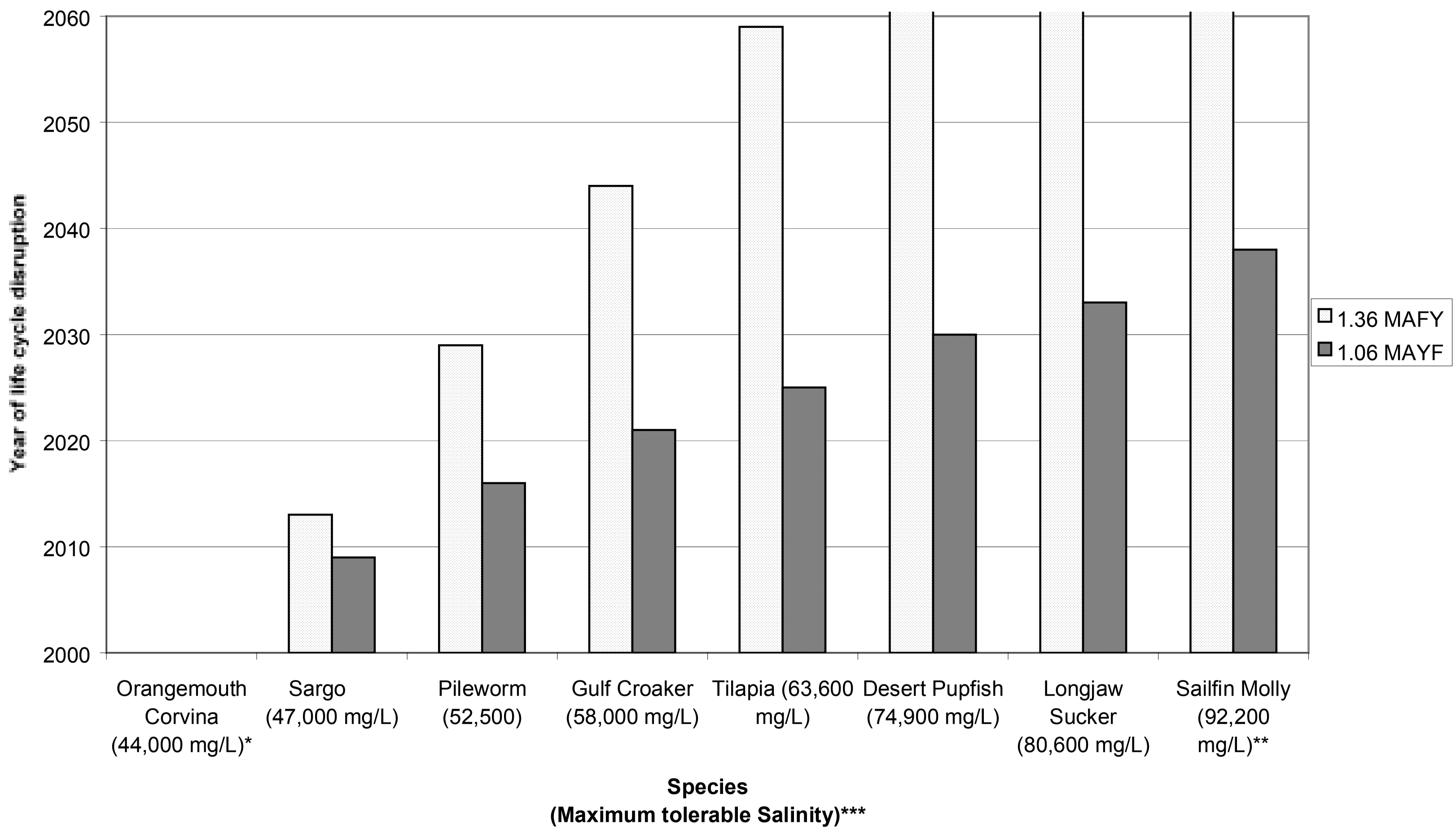
4.6.4 No Action Alternative

Under the No Action Alternative, significant direct or indirect impacts to fisheries and aquatic resources would result from increases in salinity and changes in elevation of the Sea. Under both the current (1.36 maf/yr) and reduced (1.06 maf/yr) inflow regimes the Sea would become significantly more saline. As the salinity level continues to rise under the No Action Alternative, the habitat would be impaired, and impacts to fisheries and aquatic resources would result. Table 4.6-3 and Figure 4.6-1 compare the impacts, from changing salinity, to aquatic resources over time from the two different flow regimes.

Table 4.6-2
Changes in the Water Chemistry, Biology, and Use of the Salton Sea Resulting from Increased Salinity and Decreased Depth

Water Constituent or Characteristic	Increased Salinity	Decreased Depth	Biological Effect	Use of Salton Sea
Temperature	Increased thermal capacity: water slower to warm in summer and slower to cool in winter	Potential increase in summer temperatures, decrease in winter minimum temperature	Wide temperature fluctuation may be restrictive to some species	May restrict sport fisheries
Dissolved oxygen	Decreased solubility	Increased mixing of atmospheric oxygen in near-surface water and suspension of oxygen-demanding materials from bottom	Reduces numbers of oxygen-breathing organisms. May increase number of sulfate-reducing bacteria and organisms that can utilize atmospheric oxygen	Restrict fisheries, possibly increase odor due to sulfides, would decrease fish abundance
PH	Decreased buffer ability as calcium carbonate solubility is reduced, causing pH to rise	Not known	Wide pH fluctuation may be restrictive to some species. Photosynthesis may cause wide variation in pH due to lack of buffering	Wide pH fluctuation may be restrictive to some species and subsequently may affect sport fisheries.
Turbidity	May decrease solubility of some organic substances, increasing the turbidity	Increased turbidity due to suspension of bottom material	Reduced light penetration for photosynthesis, particularly for benthic algae	Adverse effect to sport fisheries, could cause surface signal scum as algal blooms more surface dominated
Nutrients (nitrogen, phosphorus)	Causes changes in biological community and may greatly change the interaction of nutrients in algal and animal groups	Greater rate of mobilization of nutrients released from bottom sediment	Algal blooms increased; greater oxygen demands from decaying algae; greater secondary production by zooplankton	Adverse effect to fish populations at lower salinity; zooplankton may become dominated by artemia and ephydra
Trace elements	Generally reduced toxicity of some due to common ion interaction	Increased mobilization from sediment to water column may increase availability, particularly for selenium	Effect on biota uncertain. While toxicity may be reduced due to salt effects, oxidation may make some elements more available	At lower salinities, increase trace element availability could decrease abundance of fish

Figure 4.6-1 Year which Species Cannot Complete Lifecycle (based on average Sea salinity)



Notes:
* Juvenile corvina have been observed under current conditions 44,000 mg/L, this exceeds previously recorded salinity tolerances.
** based on life stage survival, lifecycle completion data not available
*** based on life cycle completion

Table 4.6-3
Estimated Year the Average Sea Salinity Level Exceeds the Maximum Salinity at which Species Can Complete their Lifecycle

Species	Year of Impact at 1.06 maf/yr Inflow Conditions	Year of Impact at 1.36 maf/yr Inflow Conditions
Orangemouth Corvina	2000	2000
Sargo	2009	2013
Pileworm	2016	2029
Gulf Croaker	2021	2044
Tilapia	2025	2059
Desert Pupfish	2030	2088
Longjaw Mudsucker	2033	Beyond 2100
Sailfin Molly	2038	Beyond 2100

Under the current flow regime the Sea level would increase slightly, while under the reduced flow regime the Sea would become smaller. Consequently, the No Action Alternative with reduced flows, in addition to more rapid increases in salinity, may affect fisheries and aquatic resources in the sea by reducing available habitat. The rates at which elevation and salinity changes depend on the average annual inflow into the Salton Sea. Specific impacts are discussed below.

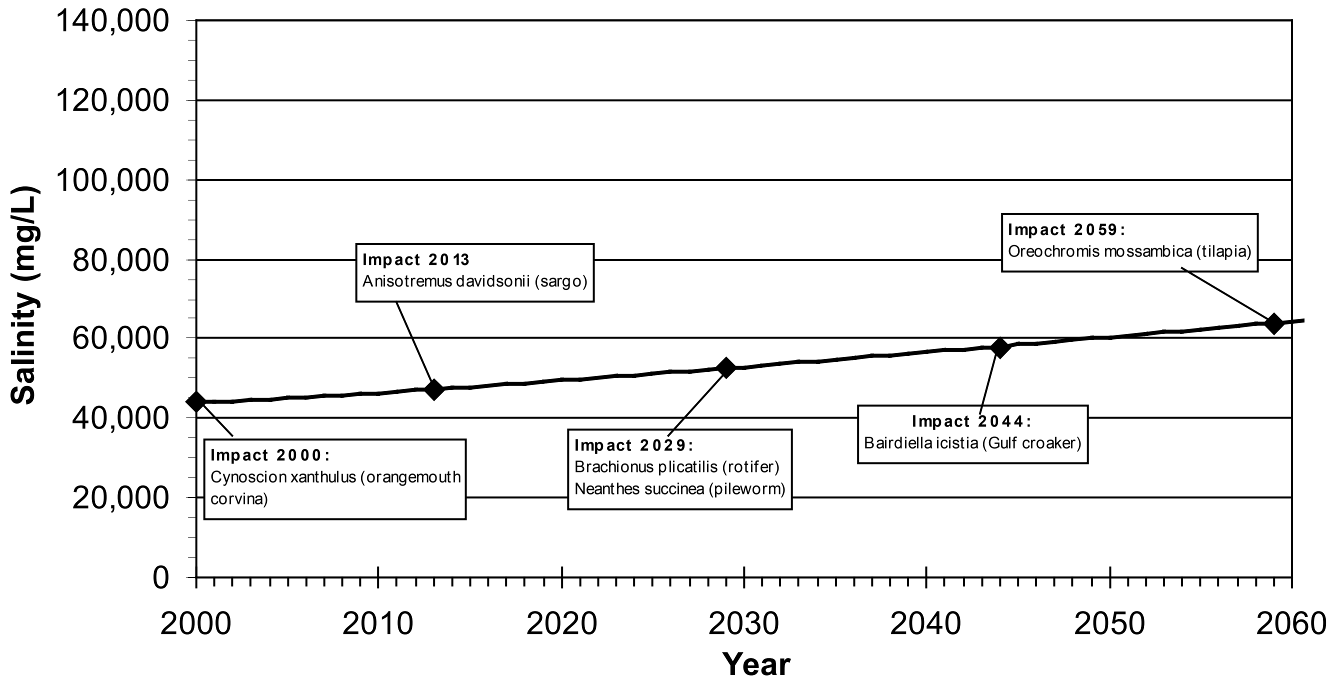
Effect of No Action with Continuation of Current Inflow Conditions

The No Action Alternative, under current inflow conditions, would result in significant and unmitigable fisheries and aquatic resource impacts. Both salinity and elevation level would not be expected to remain constant under these conditions. As discussed above, direct and indirect impacts to habitat would occur as a result of these changes in the salinity level and elevation. This in turn would have an affect on fish and other species living within the Sea. Figure 4.6-2 shows the effect of salinity changes on population dynamics under the No Action Alternative with current flow conditions.

Under the No Action Alternative with current inflow conditions, there would be little change in sediment depositional patterns, although there may be an increase in precipitation of CaCO3 and CaSO4.

The current dominant invertebrates (*Neonthes*) are predicted to stop reproducing at 52,000 mg/L salinity, which could occur within the next 30 years. This would result in a major loss of food for fish and in turn fish-eating birds. Remnant populations may survive within areas of lower salinities, such as at the mouths of rivers.

Figure 4.6-2 Predicted Year of Significant Impact Due to Salinity Increase for No Action with Current Inflow Conditions



Note:
Impact = species cannot complete lifecycle

The pileworm, *Neanthes succinea*, which is the basis of the Salton Sea food chain, has a significant reduction in reproduction when the salinity reaches 52,500 mg/L (expected to occur by the year 2029). *Brachionus plicatilis* (rotifer) will also not be able to complete its life cycle at this salinity. `This may allow amphipods, such as *Gammarus mucronatus*, to become the dominant benthic invertebrate.

The overall outcome of the No Action Alternative would be the loss of the sport fishery. While the demise of corvina, croaker, and sargo has been predicted for many years, they continue to reproduce. The available evidence indicates that corvina reproduction might fail at any time above the current salinity of 44,000 mg/L. Sargo will likely fail at approximately 47,000 mg/L (2013). By the year 2041 the salinity will reach 58,000 mg/L which exceeds the croakers ability to complete its lifecycle. This will leave tilapia as the only species large enough for sport fishing in the Sea.

Tilapia may still be present for several years beyond the other sportfish. At 63,600 mg/L (2025), tilapia's salinity tolerance for reproduction would probably be exceeded, and it is likely to disappear or experience substantial population reduction. This would leave desert pupfish, longjaw mudsuckers and possibly sailfin molly as the only fish in the Sea capable of utilizing the majority of aquatic habitats. These species probably would be able to expand their populations at this point but because these fish are small, they may not fully replace the tilapia as food for fish-eating birds, thus the fish-eating bird population would decline.

Effect of No Action Alternative with Reduced Inflows (1.06 maf/yr)

Significant and unmitigable impacts would be expected under the No Action Alternative with reduced inflows. Under these conditions, salinity levels are expected to increase, and the Sea's elevation level is expected to drop. A substantial increase in salinity levels would degrade the remaining available habitat (a level of 75,050 mg/L is expected in 30 years). Elevation is expected to drop approximately 7 feet in the first 30 years. This would cause a significant reduction in available aquatic habitat.

Due to the reduced surface elevation, rocky substrates along the shoreline in some areas would be exposed. Barnacle shell substrate would be dry. In this scenario, there would be a reduction in delta formation, but more shoreline sediments would be exposed.

In the first 30 years, polychaete density in the sea sediments probably would increase due to greater availability of oxygen. However, after 30 years the polychaete population would be greatly depressed if not absent. Egg fertilization of the pileworm (*Neanthes succinea*) has been reported to be substantially reduced at a salinity of 52,5000 mg/L and completely unsucessful over 58,000 mg/L (Kohl and Oglesby 1979).

Salinity would dictate population dynamics similar to that described above in the No Action Alternative current inflow scenario, except the timing of change would be accelerated as indicated below:

Salinity	1.06 maf/yr	1.36 maf/yr
50,000 mg/L	13 years	22 years
60,000 mg/L	22 years	49 years
70,000 mg/L	29 years	75 years

With reduced inflows, salinity levels would increase to levels significantly greater than predicted for the No Action Alternative with current inflow conditions resulting in some additional population impacts.

At about 72,600 mg/L, the copepod *Apocyclops dengizicus* could disappear (most likely the rotifers and pileworms would have died off some time before this). The copepod (*Cletocamptus dietersi*) would likely disappear at 86,400 mg/L, leaving no true zooplankton, only protozoans, to graze the phytoplankton. This could have significant effects on the species composition of the phytoplankton, with possible implications for nutrient cycling and the overall productivity of the Sea.

There is some evidence that the desert pupfish can complete their lifecycle in salinity conditions up to 74,900 mg/L (Barlow 1958). Salinity is predicted to increase beyond this level by the year 2030. Additionally, Sea elevation decreases may impede migration between the agricultural drains. Based on this prediction, impacts to desert pupfish under the No Action Alternative with reduced flows, would be significant.

Figure 4.6-3 shows the effect of salinity changes on population dynamics under the No Action Alternative with reduced flow conditions. In general, the Sea's sport fishery will likely fail by the year 2025 with the loss of corvina, sargo, croaker, and tilapia. All fish species will likely disappear from the Sea by the year 2038, leaving only water boatman, brine shrimp and brine flies.

4.6.5 Alternative 1

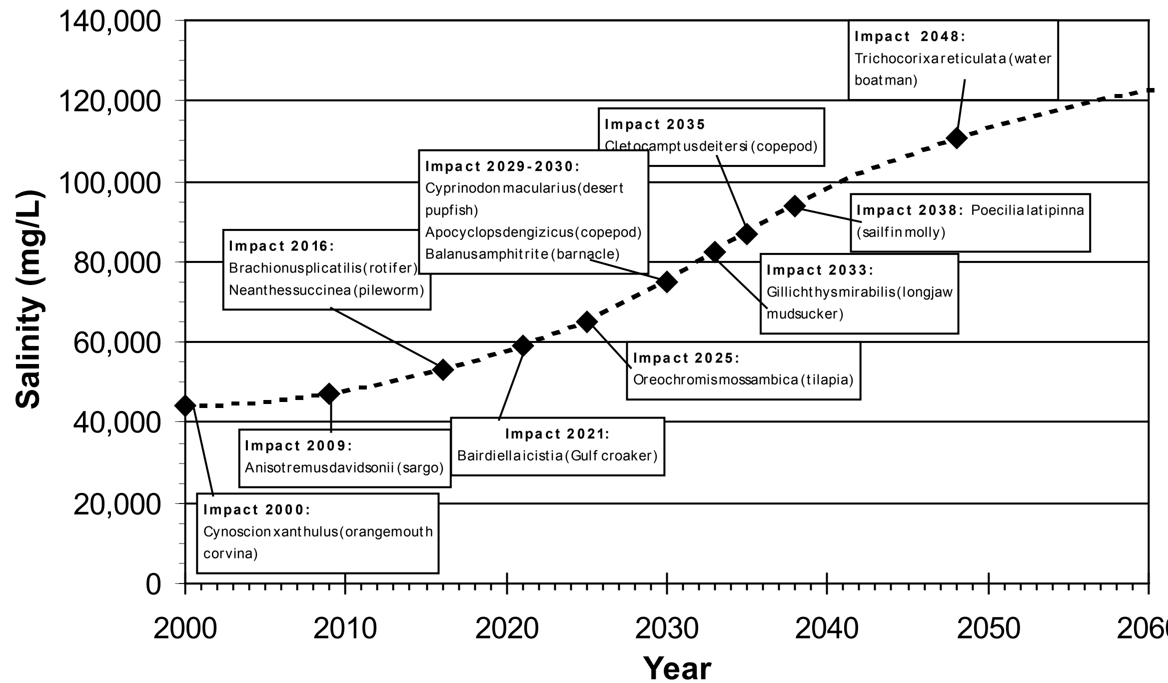
In addition to implementing the four common actions described in Chapter 5, Alternative 1 proposes to control salinity and elevation by using two evaporation ponds.

Effect of Alternative 1 with Continuation of Current Inflow Conditions

<u>North and South Evaporation ponds (98 kaf/year)</u>

Both the North and South evaporation ponds would be located in areas which are currently within the main body of the Sea. Construction activities would take place within aquatic habitats, resulting in a number of temporary adverse effects to aquatic habitat and resources. These impacts are primarily the result of dredge and fill operations and the removal of existing habitat from the Sea.

Figure 4.6-3 Predicted Year of Significant Impact Due to Salinity Increase for No Action with Reduced Inflow Conditions



Note:
Impact = species cannot complete lifecycle

Organic-rich sediment covers about 735 acres of the Sea bottom where the dike footing would be placed. The organic-rich sediment is not structurally stable and would be removed to a depth of five feet using a suction dredge. Approximately seven million cubic yards of sediment would be removed. The material would be returned to the Sea between parallel silt curtains suspended by floats from the water surface. The silt curtain would allow water to pass but would contain the solids in a path of unknown width on the Sea bottom. The dredging and disposal activities would have the following localized effects to the aquatic environment:

- Increase in turbidity may negatively impact fish and invertebrates in localized areas.
- Release of nutrients from disturbance of Sea bottom sediments, which could accelerate local eutrophication. This may result in localized anoxic conditions precluding areas from use as fish habitat.
- Oxygen depletion from hydrogen sulfide in sediment. The high organic material content of the sediment contains a considerable amount of hydrogen sulfide. Release of the sediment would increase oxygen demand, causing localized oxygen depletion with potentially adverse effects on biota. The amount of hydrogen sulfide released from the sediment is not known, but it may cause localized odor problems and can be toxic to fish and invertebrate resources.
- Blanketing of polychaetes and fish habitat by solids, which could result in food chain impacts. Dikes would greatly reduce the local numbers of polychaetes (*Neanthes succinea*) as dike material is added on top of the soft-bottom sediment in which the polychaetes reside. Polychaetes are the principle food item for many fish and shorebirds in the Salton Sea, and densities average 1,000 individuals per square meter throughout much of the Sea (Dexter et al. 1999). Walker et al. (1961) estimated the spring standing crop of *Neanthes* at 300 pounds per acre. Replacement of soft bottom material with dike fill could result in loss of about three billion polychaetes in the footprint of the dikes. It is not known if polychaetes would colonize the seaward side of the dike surface, since it would be covered with riprap. An additional 34.3 square miles of Sea bottom converted to hypersaline pond also would be devoid of polychaetes. This would constitute a loss of about 8.8×10^{10} polychaetes (Stephens 1999a). The diminishment of this food source in less than 10% of the existing area of the Sea could lead to a reduction of the area's productivity.
- Introduction of trace elements potentially contained in bottom muck or associated with the dike fill material, which could be toxic to fish populations. For example, as the sediment may be aerated during dredging, there is some potential that reduced forms of selenium, such as selenides, may be oxidized and could become mobile in water when sediment is released back to the Salton Sea.

- Disturbance of seasonal patterns (e.g., spawning) if construction activities occurred during crucial periods in the breeding activities of Salton Sea fish resources.

Overall the construction activities and subsequent temporary impacts are estimated to occur for a duration of 48 months.

Alternative 1 with current inflow conditions is expected to reduce the salinity in the Sea to 36,824 mg/L by the year 2030. This would result in improved water quality likely capable of supporting the species which currently exist in the Sea. The elevation is expected to drop 2 feet by the year 2030. This will result in the loss of aquatic habitat and reduce the surface area of the Sea by 51 square miles compared with the No Action Alternative.

The north pond dike would intersect the shoreline at both ends and result in a loss of that section of shoreline. The north evaporation dikes would create a new western shoreline further into the Sea. The loss of fish habitat along the shoreline would be a minor impact, given that suitable habitat is available elsewhere in the Sea. River and stream deltas may also be affected due to the different circulation patterns likely to develop as a result of the altered shoreline. The south evaporation pond will be constructed entirely offshore. The construction of both evaporation ponds would decrease the amount of available habitat for fish. However there would be an overall beneficial impact to the remaining fish habitat, as the evaporation ponds would stabilize salinity levels and control the elevation of the Sea.

The creation of dikes could have a positive influence on barnacles (*Balanus amphitrite*), which would likely colonize these new substrates. The appearance of large numbers of barnacles on the seaward extent of the dikes would likely attract sargo, mudsuckers, and croaker. Another beneficial impact to fish would result from the creation of deeper water habitat at the toe of the dikes. Dike rip-rap could provide habitat for fish and other aquatic species.

Creation of hypersaline environments in the ponds could promote high primary productivity of the phytoplankton, accompanied by high secondary production of invertebrates, such as brine flies and brine shrimp, which flourish above 30,000 mg/L. These organisms serve as protein sources for many fish and waterbirds. However, this benefit is short term, as salinity would continue to rise within the ponds to levels above which these species cannot survive. In addition, given that pupfish are tolerant of temperature extremes and high salinities (up to 74,900), they could live and spawn in the early stage evaporation ponds. However, the upper limit for salt concentrations in the ponds could be as high as 300,000 mg/L, which is expected to be well beyond the limits of the pupfish.

Additionally, it will be necessary to pump water from the Sea into the evaporation ponds. The intake structures for this would be screened to minimize the potential for fish entrainment.

Pupfish Pond

Pupfish migrate through the project area along the shoreline between the mouth of San Felipe Creek, and other waterways. Little is known about the movements of pupfish between the Sea and San Felipe Creek, but unobstructed access between various drainages and shallow vegetated aquatic habitat within the Sea is required (Stephens 1999a). The purpose of placing the south evaporation pond offshore would be to allow the creation of a pupfish pond. This pond would exist between the current southwest shoreline and the southwest dike of the south evaporation pond. To maintain this habitat and connectivity between the drains in this area, additional dikes would be constructed from the north and south ends of the south evaporation pond extending to the shoreline. These dikes would allow a constant water depth to be maintained as the elevation of the Sea drops. Significant snag habitat on the west side of the new River and around the mouth of San Felipe Creek would also be protected.

The pond will be managed to maintain approximately three feet depth to provide pupfish movement. It is unknown how the ponds and dikes would change circulation patterns in the Sea and in particular in the proposed pupfish pond. The dikes and circulation changes would affect nutrient turnover in backwater and marshy areas and could cause waters to stagnate and habitat to degrade. The creation of shallow water habitat along the shoreline without direct interface to the main body of the Sea may result in a number of impacts.

- The ponds could affect the freshwater inflow to the Sea by intercepting some of that flow, resulting in increasing salinity to the main body of the Sea.
- The ponds would isolate the shoreline area from the rest of the Sea, losing the flushing action naturally found which assists in temperature moderation, DO control and exchange, sediment transport, dilution of constituents and potential contaminants entering the pond area from drains, and general cleansing action.
- Increased sedimentation would result in the need for additional dredging. This would cause similar impacts to fishery resources as discussed above for dredging and disposal activities.
- Increased concentration of birds may result in increased concentration of avian diseases.
- Increased concentration of birds may result in increased predation on fish and invertebrate species including desert pupfish.
- The difficulty in maintaining adequate flow through the area and increased concentration of avian fecal matter and general stagnation. This may increase eutrophic conditions and accelerate the decline in water quality within the protection pond.
- Degraded water quality may result in the loss of invertebrates in the shallow area

- The long duration of construction activities may result in significant disturbance.
- The dikes could provide nesting sites for predatory species (i.e. gulls).
- Wind driven circulation of the Sea would be altered by placement of these structures which would also alter delta formation. Impacts to fish and invertebrates is uncertain.
- The high level of evaporation likely to occur in shallow water habitat may make maintenance of salinity within the ponds would be difficult.
- The diversion of drainage flows into the ponds may result in increased food chain concentration of undesirable constituents (selenium)

North Wetland Habitat

Reduced annual inflows would also threaten the most important wetland habitat currently utilized by fish and wildlife in the northern portion of the Sea. These wetlands provide the largest expanse of snag habitat at the Sea. This action would include construction of dikes at the –230 foot contour on both sides of the Whitewater River Delta to protect existing nearshore and snag habitat by maintaining shallow wetland habitat at the northern end of the Sea. The habitat would have up to 3 feet of water depth and would ensure that the several small islands within the area would not become connected to the shoreline due to drops in water surface elevation. The location of the northern wetland habitat is shown on Figure 2.4-6.

The construction would isolate the wetland area from the main body of the Sea while still allowing the mouth of Whitewater River to flow directly into the Sea. The water levels within the wetland habitat would be maintained by pumping or diverting water from the Whitewater River and allowing it to gravity flow back into the Sea. Potential impacts are similar to those described for the pupfish pond. In addition, the gravity flow back into the Sea may allow pupfish and other species to migrate out of the shallow water areas and into the main body of the Sea. However, due to the flow of the Whitewater River they may not be capable of migrating in the reverse direction (from the sea into the North Wetland Habitat). The location of the North pond may conflict with current use of the area including private duck clubs.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

Under Alternative 1 with reduced inflow conditions both evaporation ponds and the pupfish pond would be created as described above. As the reduction in inflow is predicted to result in accelerated salinity increases and reduced surface elevation, additional actions (displacement dike) would be implemented. With the incorporation of these additional actions, Alternative 1 with reduced flows is anticipated to result in a salinity level of 45,862 mg/L by the year 2030. This increase in salinity is small compared with the 75,050 mg/L salinity level predicted for the No Action Alternative. By controlling the salinity, Alternative 1 would result in an overall beneficial impact to aquatic resources.

The elevation of the Sea is expected to drop 10 feet by the year 2030. This elevation drop combined with the additional Alternative 1 construction would result in a loss of 95 square miles of aquatic habitat from current conditions. This is compared with a predicted loss of 37 square miles of aquatic habitat under the No Action Alternative with reduced flows. The potential impacts from the additional actions which would be triggered by the reduced inflows are presented below.

Displacement Dike

A displacement dike would be constructed in the southern portion of the Sea as shown on Figure 2.4-4. It is designed to reduce the total area of the Sea, effectively displacing enough water to maintain surface elevations if annual inflows are reduced to 1.06 maf per year. Construction activities for the displacement dike would temporarily disturb approximately 360 on-shore acres, would take approximately 48 months to complete, involving a maximum of 300 to 330 workers. These temporary impacts within the Sea will be similar to the construction impacts discussed for the evaporation pond construction. In-Sea area disturbed or occupied by new structures would total approximately 520 acres.

4.6.6 Alternative 2

Alternative 2 proposes to construct an EES North of Bombay Beach in order to reduce the salinity and control the elevation of the Sea. In addition, the four common actions described in Chapter 5 would be implemented.

Effect of Alternative 2 with Continuation of Current Inflow Conditions

EES Located North of Bombay Beach (150 kaf/year – showerline technology)

Construction of the EES east of Bombay Beach would have a minor short-term impact on fisheries and aquatic resources as the majority of construction activities would take place upland. Construction of the intake structure would create a temporary negative impact on the aquatic habitat in the area. The intake structure would include a screened pipe approximately 87 inches in diameter. The horizontal intake structure would contain a trash rack and fish screens in order to minimize its impact on aquatic resources.

Under this alternative, salinity is expected to be 45,510 by the year 2030. This is close to the current salinity level and significantly lower than the salinity level predicted for the No Action Alternative. This would result in a salinity level likely tolerable by the species which currently reside in the Sea.

Sea levels would be stabilized at –232 ft msl, eight feet lower than under the No Action Alternative conditions, resulting in a loss of 29 more square miles of aquatic habitat. This would have a short-term adverse effect on fish, but it is not expected to impair long-term foraging opportunities, reproduction, or migration.

Effect of Alternative 2 with Reduced Inflow Conditions

Under alternative 2 with reduced inflow conditions the EES north of Bombay Beach would be constructed as described above. The reduced inflows would result in a more rapid drop in elevation and increase in salinity than is predicted for current inflow conditions. In order to address these issues, several additional actions (displacement dike, and North wetland habitat, and import of floodflows) will be taken. The salinity is expected to rise to 53,726 by the year 2030. This salinity would likely negatively impact the populations of orange-mouth corvina and sargo.

The elevation of the Sea is expected to drop 10 feet to –237 by the year 2030. This elevation drop would result in a loss of 70 square miles of aquatic habitat compared with a predicted loss of 37 square miles under the No Action Alternative. The potential impacts from additional actions are described below.

Displacement Dike

A displacement dike would be constructed essentially reducing the size of the Sea in order to maintain the surface elevation. The impacts of this action are described in Alternative 1 with reduced flow conditions.

North Wetland Habitat

A protection pond will be constructed along the north shore as described in Alternative 1 with reduced inflow conditions. Temporary and long-term impacts are expected to be the same as those described for Alternative 1.

Import Flood Flows

Inflows to the Sea would be augmented with flood flows from the Colorado River. Colorado River flood flows would typically be available every three to seven years. The flows would be carried to the Sea by the All American Canal and the Alamo River and about 700 cfs would be diverted through the Coachella Canal through the evacuation channel located at Detention Channel #1. This would result in approximately 300,000 acre-feet being available over the four months during the years when flood flows occur.

By carrying flood flows through the existing channels there is the potential to significantly impact the aquatic resources occupying the Alamo River. Detention Channel #1 is dry the majority of the time and does not supoort aquatic resources. The flows also have the potential to remove submergent vegetation and erode channel banks. It may be necessary to regulate these flows to minimize these potential impacts.

4.6.7 Alternative 3

Alternative 3 proposes to construct an EES at the Salton Sea Test Base in order to reduce the salinity and control the elevation of the Sea. In addition, the four common actions described in Chapter 5 would also be implemented. The only difference between Alternative 2 and Alternative 3 is the location of the EES

Effect of Alternative 3 with Continuation of Current Inflow Conditions

The predicted salinity and elevation changes for Alternative 3 would be the same as those described above for Alternative 2. Short-term and long-term impacts to aquatic resources would also be similar.

Effect of Alternative 3 with Reduced Inflow Conditions

Construction of the EES on the former Salton Sea Test Base under reduced inflow conditions would have a minor short-term impact on fisheries and aquatic resources. Short-term and long-term impacts would be similar to those described under Alternative 2. Alternative 3 with reduced flows would include the construction of a displacement dike, Southwest and North wetland habitat, and imported flood flows similar to those described for Alternative 2.

4.6.8 Alternative 4

In addition to implementing the four common actions, Alternative 4 proposes to construct an EES at the Salton Sea Test Base and an evaporation pond in the south west section of the Sea.

Effect of Alternative 4 with Continuation of Current Inflow Conditions

South Evaporation Pond (68 kaf/year) and an EES Located at the Salton Sea Test Base (100 kaf-year – showerline technology)

Construction activities for the South evaporation pond would take place within the Sea, resulting in a number of temporary adverse effects to aquatic habitat and resources. These impacts are primarily the result of dredge and fill operations and the removal of existing habitat from the Sea. Impacts for the construction of the South evaporation pond were described in Alternative 1. However, Alternative 4 will not impact as much in-Sea aquatic habitat because only the South evaporation pond will be constructed.

Short-term and long-term impacts resulting from the construction of an EES at the Salton Sea Test Base are similar to those described in Alternative 3, the size of the EES for Alternative 4, would be reduced to a capacity of 100,000 acre-feet per year.

The combination of the South concentration pond and the EES would increase the effectiveness and speed at which salts are removed from the Sea compared with alternatives 2 and 3 with less aquatic habitat disturbance than Alternative 1. The Salinity of the Sea is expected to be reduced to 39,566 by the year 2030. This reduced salinity level would be a beneficial impact for all of the aquatic species currently occupying the sea.

The elevation of the Sea is anticipated to drop 2 feet from its current level by the year 2030. This would result in a loss of 40 square miles of aquatic habitat. This is compared with almost no change in aquatic habitat area with the No Action Alternative. Although this would be a significant loss of habitat the overall improvement in water quality conditions in the Sea would result in a net benefit for aquatic species compared with the No Action Alternative.

Pupfish Pond

Alternative 4 would also include the construction of a pupfish pond in the area between the existing Southwest shoreline and the proposed South evaporation pond as described in Alternative 1 with current inflow conditions.

North Wetland Habitat

A protection pond will be constructed along the north shore as described in Alternative 1 with reduced inflow conditions.

Effect of Alternative 4 with Reduced Inflow Conditions

Under Alternative 4 with reduced inflow conditions the South evaporation pond, EES at Salton Sea Test Base, and the pupfish ponds would be created as described above. As the reduction in inflow is predicted to result in accelerated salinity increases and elevation decreases, the additional actions (displacement dike, North wetland habitat, and Imported Flood Flows) would be implemented. With the incorporation of these additional actions, Alternative 4 with reduced inflows is anticipated to result in a salinity level of 47,467 mg/L by the year 2030. This is a significant beneficial impact compared with a predicted (year 2030) salinity of 75,050 mg/L for the No Action Alternative.

The elevation of the Sea is expected to drop 8 feet by the year 2030. This elevation drop combined with the additional Alternative 4 actions would result in a loss of 80 square miles of aquatic habitat. This is compared with a predicted loss of 37 square miles of aquatic habitat under the No Action Alternative with reduced flows. The potential impacts from the additional actions are presented below.

Displacement Dike

A displacement dike would be constructed essentially reducing the size of the Sea in order to maintain the surface elevation. The impacts of this action are described in Alternative 1 with reduced inflow conditions.

Import Flood Flows

Flood flows would be imported from the Colorado River as described in Alternative 2 with reduced inflow conditions.

4.6.9 Alternative 5

In addition to implementing the four common actions, Alternative 5 proposes to construct an EES (using portable ground based blower technology) within the North evaporation pond.

Effect of Alternative 5 with Current Inflow Conditions

EES Located within the North Evaporation Pond (150 kaf/year EES – Ground based blower technology)

Construction of the North evaporation pond would result in the same short-term and long-term impacts described in Alternative 1 minus the impacts from the construction of the South evaporation pond. The additional installation of portable ground based blowers would result in minimal impacts to aquatic resources. The intake structures for the EES would be similar to that described in Alternative 2 with a fish screen and trash rack structure to minimize fish entrainment.

This alternative would extend the operational life of the North evaporation pond by 100 years compared to Alternative 1. The salinity is expected to be reduced to 40,841 mg/L by the year 2030. This reduced salinity level would be a beneficial impact to aquatic resources. Under current inflow conditions the elevation of the Sea is expected to drop 6 feet in the first 30 years. This would result in a loss of 40 square miles of aquatic habitat. This would be a significant reduction in available habitat, however the improved water quality conditions would result in a net beneficial impact for aquatic resources.

North Wetland Habitat

In order to protect the shallow water habitat which would be lost as the elevation of the Sea drops, the North wetland habitat would be developed. The impacts resulting from this wetland habitat are similar to those described in Alternative 1 with reduced inflow conditions.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Under Alternative 5 with reduced inflow conditions the EES within the North evaporation pond and the North wetland habitat would be created as described above. As the reduction in inflow is predicted to result in accelerated salinity increases and elevation decreases, the additional actions (displacement dike, and Imported Flood Flows) would be implemented. With the incorporation of these additional actions, Alternative 5 with reduced inflows is anticipated to result in a salinity level of 46,175 mg/L by the year 2030. This is a significant beneficial impact compared with a predicted (year 2030) salinity of 75,050 mg/L for the No Action Alternative.

The elevation of the Sea is expected to drop 10 feet by the year 2030. This elevation drop combined with the additional Alternative 5 actions would result in a loss of 75 square miles of aquatic habitat. This is compared with a predicted loss of 37 square miles of aquatic habitat under the No Action Alternative with reduced flows. The potential impacts from the additional actions which would be triggered by the reduced inflows are presented below.

Displacement Dike

A displacement dike would be constructed essentially reducing the size of the Sea in order to maintain the surface elevation. The impacts of this action are described in Alternative 1 with reduced flow conditions.

Import Flood Flows

Flood flows would be imported from the Colorado River as described in Alternative 2 with reduced inflow conditions.

4.6.10 Cumulative Effects

Implementation of restoration activities would not have any significant adverse cumulative impacts when assessed with other past, current, and future projects in the region. The Brawley wetlands project, the Heber wastewater treatment system project, and the drain water quality improvement plan would improve inflows into the Sea from the New River.

4.6.11 Mitigation Measures

The following measures are suggested as the minimum actions required to reduce impacts associated with restoration alternatives and actions to less than significant levels as they affect fisheries and aquatic resources:

Implement construction activities during nonspawning periods.

For any habitat lost to proposed actions, remaining habitat should be carefully monitored for salinity levels, turbidity levels, and other water quality effects. If any areas are specifically used for spawning, these should be avoided during construction wherever possible.

Water Quality (including temperature, dissolved oxygen, salinity, and chemical constituents) should be monitored in the pupfish pond and North Wetland Habitat.

4.6.12 Potentially Significant Unavoidable Impacts

Both the No Action Alternative and the five action alternatives result in a change in the Sea elevation. Consequently, regardless of which Action or No Action alternative is taken the shallow water habitat that currently exists and is utilized by a number of species will change.

Additionally, salinity levels will increase for a period of time regardless of which Action or No Action alternative is chosen. It is currently believed that the orange-mouth corvina is nearing its upper salinity tolerance level. As a result this species may be significantly impacted within the next few years.

4.7 AVIAN RESOURCES

4.7.1 Summary of Environmental Consequences

Significant and unmitigable avian resource impacts would occur under the No Action Alternative as a result of increases in salinity and large-scale changes in habitats. These changes would affect most all avian resources associated with the Salton Sea, both resident and migratory. A significant beneficial impact would occur under alternatives 1 through 5 to aquatic avian species dependent on the aquatic resources of the Salton Sea due to improved water quality conditions and protection of aquatic prey species. However, there would be localized significant unmitigable impacts under alternatives 1, 2, 3, 4, and 5 due to direct loss of habitat.

4.7.2 Significance Criteria

Significant avian resource impacts would occur if one of the alternatives would substantially alter the current bird usage patterns of the Salton Sea and surrounding areas for foraging, roosting, and nesting resulting in reduced bird numbers or increased health problems. Criteria used to evaluate the significance of impacts to avian resources are derived from the legal (federal and state) requirements to protect special status species and sensitive habitats, as described in Chapter 3. Specific criteria also may take into account issues identified during public scoping of the EIS/EIR, discussions with USFWS and CDFG, in other reports addressing potential impacts of various land uses at Salton Sea on avian resources.

An alternative could have a significant avian resource impact if its implementation would result in any of the following:

- Harm to, harassment of, or destruction of individuals of any avian species listed as endangered, threatened, or rare under federal or California law. In addition, such impacts are considered significant to other avian species under the following conditions:
  - survival and reproduction of a species in the wild are in immediate jeopardy;
  - the species exists in such small numbers throughout all of or a significant portion of its range that it may become endangered if its environment worsens due to the project;
  - the species is likely to become endangered in the foreseeable future and may be categorized as threatened under federal law;
- Modification or destruction of the habitat, migration corridors, or breeding areas of endangered, threatened, rare, or other avian species, as defined in the preceding paragraphs; or
- Loss of a substantial number of any avian species that could affect abundance or diversity of that species beyond normal variability; or
- Measurable degradation of sensitive habitats, such as wetlands and other legally protected habitats.

4.7.3 Assessment Methods

Potential impacts to avian resources are assessed by comparing proposed changes in habitat use under each of the alternatives to the no action conditions. Existing avian resource status, as described in Chapter 3, form the basis for assessing the significance of changes to avian resources under each of the alternatives.

4.7.4 No Action Alternative

Under the No Action Alternative, significant and unmitigable impacts to avian resources would occur due to several factors. The continued increase in salinity to 52,896 mg/L in 30 years would have a significant impact on those avian species that depend on the aquatic ecosystem of the Sea. Concentration of minerals and contaminants could cause direct mortality in those avian species that spend large amounts of time in or exposed to the waters. Fluctuations in the water levels of the Sea would affect birds that use the shores for nesting and those that rely on certain shoreline habitats for food, refuge, or roosting as high salinity levels would preclude revegetation. Because of the important linkage that exists between environmental quality and disease, it is reasonable to assume increases in bird losses from disease under the No Action Alternative. As avian species are concentrated into decreasing areas of suitable habitats both in and around the Sea, avian diseases that spread readily in dense population conditions could further affect birds using the Sea. In addition the aquatic prey base would be lost as the salinity level increases, further stressing those species that depend on that resource. These combined effects would reduce populations of most species using the Sea, particularly the fish-eating and shoreline-nesting species.

Effect of No Action Alternative with Continuation of Current Inflow Conditions

Significant and unmitigable avian resource impacts would occur under the No Action Alternative in conjunction with continuation of the current flow conditions. Salinity in the Salton Sea is expected to continue to rise under this scenario, reaching 52,896 mg/L in 30 years. Most fish and invertebrate populations would be severely affected at salinity levels above 50,000 mg/L, significantly reducing food for many of the avian species. Although most of the fish and invertebrate species would be affected, a few would increase for a number of years. For example, as salinity levels approach 80,000 mg/L, which would be reached in about 100 years, brine shrimp (*Artemia franciscana*) and brine flies (*Ephydra* sp.) would dominate the zoobenthic community but eventually would decline as salinity levels continue to rise. Avian species, such as eared grebes and phalaropes, which feed on brine shrimp and brine flies, also may benefit temporarily but eventually would decline as their prey species decline.

The Salton Sea serves as an important breeding or wintering area for many species, such as ruddy ducks, eared grebes, white pelicans, and gull-billed terns (a federal species of concern). More than 30 percent of the population of these species depend on the Salton Sea. Because the aquatic resource they depend on would be drastically reduced, it is likely that the survival of these species and others may be jeopardized. Only resident upland species or those migratory species that feed in the agricultural areas would not be significantly affected.

Effect of No Action Alternative with Reduced Inflows (1.06 MAFY)

Significant and unmitigable impacts would be expected under the No Action Alternative with reduced inflows. Under these conditions, Sea level would drop by 10 feet. Effects of this drop would be widespread. The negative effects described above would be made far more severe as salinity would increase at a faster rate, reaching 80,050 mg/L in 30 years and accelerating the impacts to avian resources. The drop in water level would dry out some of the remaining nearshore wetland and marsh areas that provide valuable nesting and feeding areas, reducing this habitat by up to 600 acres. Reduction of wetland and marsh habitat would adversely affect breeding sites for white-faced ibises and black terns, while the loss of cattails would affect the least bitterns. In addition, a land bridge would be formed between Mullet Island and the mainland, putting severe pressure on nesting birds by predators. Those avian species that seek refuge and roosting in marsh areas would be forced to leave the region. With no nearby replacement habitat, the overall populations of many of these species in the Pacific Flyway would likely decrease. The impacts to those species, 30 percent or more of which depend on the aquatic resources of the Sea, would be similar to those described above.

4.7.5 Alternative 1 with Continuation of Current Inflow Conditions

Effect of Alternative 1 with Continuation of Current Inflow Conditions

North and South Evaporation Ponds (98kaf/y). Construction and operation of the concentration ponds under Alternative 1 would result in significant and unmitigable impacts to upland avian species, the result of direct loss of habitat. Beneficial impacts would occur to aquatic species, as the operation of the ponds would reduce the salinity levels of the Salton Sea to 36,824 mg/L compared to 52896 mg/L under no action conditions.

Construction activities would temporarily disturb some areas along the shoreline affecting shorebird use in the area and would take approximately 48 months to complete and would involve a maximum of 440 to 480 workers. Construction resources are included on Table 2.4-3; the location of the evaporation ponds is shown on Figure 2.4-4.

The construction of containment dikes, although placed completely in the Sea, would remove 140 acres of nearshore habitat. Many shorebirds use these areas for feeding year-round. Additional short-term effects of the concentration ponds on the southwest shore would result from their attractiveness to many avian species. Initially these ponds would provide habitat for brine shrimp and avian species that would feed on them. Ultimately the ponds would become so salty that no invertebrates could survive in them. However these pond would still appear to be suitable habitats for species searching for a feeding or resting sites. Such species as the state-listed species of concern black skimmers (*Rynchops niger*) and the federal species of concern elegant terns (*Sterna elegans*) would attempt to feed in the waters even though fish could not survive in the ponds. In addition to the high salinity levels many metals of concern, such as lead, zinc, copper and cadmium may precipitate from the brine as chlorides and could become concentrated in the brine and may have detrimental and unmitigable effects, especially for young birds and those not acquiring fish at more suitable locations. Birds feeding from the shore of these ponds, such as snowy egrets (*Egretta thula*) and great egrets (*Ardea alba*), would be exposed in a similar manner, if not more severely, as their foraging ranges tend to be smaller than those of black skimmers and elegant terns. However, operation of the ponds would result in a reduction in salinity in the Salton Sea proper, preventing the loss of the prey base for these species that would occur under no action conditions. The Sea level would drop by 5 feet under this scenario, further impacting nearshore habitat.

Construction and use of a haul road would affect upland avian species by direct loss of habitat and by noise that would be introduced into areas where upland species feed, nest, and roost. These effects would be mitigable if destruction of habitat is minimized and the road is removed and the footprint is restored to current conditions as quickly as possible.

Pupfish Pond. To maintain this habitat and connectivity between the drains in this area, sheet pile driven dikes would be constructed from the north and south ends of the southwest evaporation pond extending to the shoreline, effectively creating a nearshore habitat protection pond between the shore and the evaporation pond. Significant snag habitat on the west side of the New River and the habitat around the mouth of San Felipe Creek would also be protected within this pond. Salinity levels appropriate to maintain conditions suitable for pupfish habitat would be attained by using a pump system, bringing in Salton Sea water to mix with a smaller portion of drain water.

Construction of these facilities would preserve critical nearshore habitat for shorebirds and birds requiring snags for nesting and roosting. Maintaining the water quality conditions suitable for pupfish would insure suitable water for continued nearshore vegetation growth. However, it is likely that the pond and associated waterway would become highly eutrophic with high solar gain. The less saline ponds would likely concentrate water birds, such and grebes, white pelicans, and ducks in an area where transmission of avian diseases is likely, promoting the continued die-offs currently occurring.

North Wetland Habitat. The impacts of these features would be much the same as those described for the Pupfish Pond.

4.7.6 Alternative 1 with Reduced Inflow Conditions (1.06 MAFY)

Facilities associated with this alternative include those described under current inflow conditions plus the displacement dike and the North Wetland Habitat Impacts would be the same as those described above in the current inflow scenario, except that salinity levels would be reduced to 45,862 mg/L. Although most aquatic prey species can survive at this level, their populations would be stressed. However, there still would be an overall beneficial impact to avian species that depend on the aquatic ecosystem. The Sea level would be only three feet lower than it would be under the No Action Alternative at the end of 30 years, having minimal impacts on nearshore habitat.

Displacement Dike. This dike would be constructed in the southern portion of the Sea as shown on Figure 2.4-4. It is designed to essentially reduce the total area of the Sea, effectively displacing enough water to maintain elevations if annual inflows are reduced to 1.06 maf per year. Construction activities for the displacement dike would temporarily disturb approximately 360 on-shore acres, would take approximately 48 months to complete, involving a maximum of 300 to 330 workers. This feature would have little long-term effects on avian resource using the Sea compared to the no action alternative.

4.7.7 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

EES Located North of Bombay Beach (1.50 kaf/year – Showerline Technology). Construction of the EES north of Bombay Beach could have significant and unmitigable impacts on upland and aquatic avian species. These impacts could affect a wide variety of species, particularly those that are migratory, leading to notable population declines in other locations along the migratory flyway. Approximately 13,000 acres of desert habitat would be lost which would affect a large number of avian species from loss of foraging and nesting habitat. The area is characterized as creosote bush scrub dominated by creosote bush, burro weed and brittle brush. This in turn could affect those species that prey on these birds.

The EES would decrease the salinity to 45,510 mg/l from 52,896 mg/l under the no action alternative. This would result in a beneficial impact to aquatic avian species and those upland species dependent on the Sea. The sea elevation would drop by an estimated 8 feet at the end of 30-years which would have a significant effect on nearshore habitat, reducing that habitat by an estimated 500 acres that would result in impacts similar to those discussed for Alternative 1 under reduced flow conditions.

The waters within the EES system could potentially be toxic to avian species due to the highly elevated salinity and any contaminants. Effects of this toxicity could affect reproductive success of species that breed in areas other than the Sea but stop at the Sea for feeding or resting enroute.

Other hazards could occur from bird exposure to the sprayed waters within the EES and collision with the spray towers. The extensive spray systems would create a curtain of highly saline water through which birds may fly. Birds flying through this spray would become coated with highly saline water and would ingest significant amounts of salt after preening salt soaked feathers. In addition birds that land in the ponds may become encrusted with salt.

Locally migrating birds would be killed from collisions with the evaporation towers and piping. According to McKenan (1982) there are significant migrations within the Salton Sea basin. Night movements are extensive. For example, 5,000 widgeon at Davis Road moved in the middle of the night to raft on the sea. In the regions of Bombay Beach and Salton City 70,000 to 80,000 birds per hour flying below 90 meters were recorded past a one-mile radar line stationed at Del Rio Golf Course and at Mecca.

A review of the literature revealed an extensive body of data concerning bird collisions with towers and wires. Many of these collisions occurred at night in inclement weather or fog. Elkins (1988) reported that "Bird mortality caused by inclement weather and collision with power lines . . . happens most frequently to nocturnal migrants in dense fog or clouds accompanied by precipitation. The refraction and reflection of light by water droplets increase the sphere of illumination and confuse the migrants. Others have also reported bird deaths due to collisions that have occurred with fog and changes in weather (Kibbe 1975; Laskey 1971). Spray from the EES could mimic fog, causing the same problems for migrating birds.

Migration peaks also are associated with massive bird deaths from colliding with towers. From October 5 to 8, 1954, coinciding with an advancing cold front, 25 instances of mortality, totaling over 100,000 birds (88 species), were reported from ceilometers, towers, and buildings in the eastern US. The massive bird mortalities were associated primarily with nocturnal fall migration (Johnston and Haines 1957).

A report compiled by NUS Corp (1979) found factors that influence the frequency of collisions, as follows:

- Poor visibility due to weather or time of day;
- Weather (winds, rain) that causes birds to fly lower than normal;
- Disturbances and distractions (mating, pursuit of/by prey);
- Cable size (smaller wires cause greater frequency of collisions than larger ones);
- Age (young birds collide more often than adults); and
- Line location (those below treetops are less hazardous than more exposed flight lines).

Species with long legs and necks collide more often than species with shorter appendages. High wing loading, as in swans, reduces the ability to maneuver around lines. Weir (1976) stated that "Nocturnal bird kills are virtually certain wherever an obstacle extends into the air space where birds are flying in migration. The time of year, sitting, height, lighting and cross-sectional area of the obstacle and weather conditions would determine the magnitude of the kill."

Placement of the EES system on the eastern edge of the Salton Sea would likely interfere with bird migration patterns and create the potential for large numbers of birds to be lost due to collisions. This impact is considered unmitigable, as methods for preventing collisions in other circumstances elsewhere have been highly ineffective.

North Wetland Habitat. The impacts of the North Wetland Habitat would be similar to those described under Alternative 1.

Effect of Alternative 2 with Reduced Inflow Conditions

This alternative includes all of the facilities described under the Current Inflow Conditions plus the displacement dike, the North Wetland Habitat and Imported Flood Flows.

Impacts of Alternative 2 with reduced inflow would have a significant and unmitigable impact to upland avian resources and beneficial impacts to avian species dependent on the aquatic resources of the Salton Sea and would be the similar to those described above in the current inflow scenario, except that salinity levels would drop from 75,050 mg/l to 45,510 mg/l. Most aquatic prey species can survive at this level though their populations would be stressed, resulting in an overall beneficial impact to avian species dependent on the aquatic ecosystem. Sea elevations would drop by three feet which would have little impact on nearshore habitat compared to the no-action alternative.

Displacement Dike. The impacts of the displacement dike would be similar to those described under Alternative 1under the low flow conditions.

Import Flood Flows. In addition to those actions described above, Alternative 2 with reduced inflows would include augmenting inflow to the Sea by using flood flows from the Colorado River. Colorado River flood flows are generally available approximately every three to seven years. The flood flows would eventually be released through the Alamo River and the Coachella Evacuation Channel. Up to 300,000 acre-feet or a total of 1250 cfs could be available during flood releases over a one to four month period. Release of these high flows over an extended period would cause increased erosion in the Alamo River causing a degradation or loss of wetland habitat impacting avian species dependent on that habitat.

4.7.8 Alternative 3

Effect of Alternative 3 with Continuation of Current Inflow Conditions

EES located at the Salton Sea Test Base (150kaf/year) – Showerline technology). Construction of the EES on the former Salton Sea Test Base would have a significant and unmitigable impact to upland avian resources and beneficial impacts to avian species dependent on the aquatic resources of the Salton Sea. These impacts would be similar to those described under Alternative 2.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 MAFY)

Construction of the EES on the former Salton Sea Test Base would have a significant and unmitigable impact to upland avian resources and beneficial impacts to avian species dependent on the aquatic resources of the Salton Sea. These impacts would be similar to those described under Alternative 2.

Displacement Dike. Impacts for this facility would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow conditions.

4.7.9 Alternative 4

Effect of Alternative 4 with Continuation of Current Inflow Conditions

South Evaporation Pond (68 kaf/year) and an EES located at Salton Sea Test Base (100 kaf/year – Showerline Technology. Construction of the concentration ponds and the EES at the Salton Sea Test Base would result in significant and unmitigable impacts to upland avian species. Impacts would be the same as those described above under alternatives 1 and 3. The combined effects of impacts to avian resources from the EES and concentration ponds under Alternative 4 would be more severe than those under alternatives 1, 2, or 3. Significant beneficial impacts would occur as salinity levels are reduced to 39,566 mg/L, compared to 52,896 mg/L under no action conditions. Aquatic resources are expected to significantly benefit by this reduced salinity which would benefit those avian species dependent on the aquatic ecosystem of the Sea. However, the sea level would drop by 5 feet causing a loss of 300 acres of nearshore habitat.

Pupfish Pond. The impacts of pupfish pond would be similar to those described under Alternative 1under the low flow conditions.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1.

Effect of Alternative 4 with Reduced Inflow Conditions

Construction of the concentration ponds and the EES at the Salton Sea Test Base would result in significant and unmitigable avian resource impacts. Impacts would be the same as those described above under alternatives 1 and 3. The combined effects of impacts to avian resources from the EES and concentration ponds under Alternative 4 would be more severe than those described under alternatives 1, 2, or 3. Significant beneficial impacts would occur as salinity levels are reduced to 47,467 mg/L, compared to 75,050 mg/L under no action conditions.

Displacement Dike. Impacts for this facility would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow conditions.

4.7.10 Alternative 5

EES Located Within the North Evaporation Pond (150 kaf/year EES – Ground Mounted Spray Technology. Under Alternative 5, EES would be constructed within the north evaporation pond and ground mounted spray units would replace the tower and showerline units proposed for Alternatives 2 and 3. Construction and operation of the EES would reduce the salinity levels of the Salton Sea to 40,841 mg/L compared to 52,896 mg/L under no action conditions. Aquatic resources are expected to significantly benefit by this reduced salinity which would benefit those avian species dependent on the aquatic ecosystem of the Sea.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

The level of the Salton Sea would drop by approximately 9 feet significantly impacting nearshore habitat. Approximately 600 acres of this habitat would be lost and the impacts would be similar to those described under the No Action Alternative under low flow conditions.

The construction of containment dikes, although placed completely in the Sea, would remove 5 acres of nearshore habitat. Many shorebirds use these areas for feeding year-round. Additional short-term effects of the concentration ponds would result from their attractiveness to many avian species. The ponds would appear to be suitable habitats for species searching for a feeding or resting location. Such species as the state-listed species of concern black skimmers (*Rynchops niger*) and the federal species of concern elegant terns (*Sterna elegans*) would attempt to feed in the waters even though fish could not survive in the ponds. The extremely high salinity levels of the water may have detrimental and unmitigable effects, especially for young birds and those not acquiring fish at more suitable locations. Birds feeding from the shore of these ponds, such as snowy egrets (*Egretta thula*) and great egrets (*Ardea alba*), would be exposed in a similar manner, if not more severely, as their foraging ranges tend to be smaller than those of black skimmers and elegant terns. However, operation of the ponds would result in a reduction in salinity in the Salton Sea proper, preventing the loss of the prey base for these species that would occur under no action conditions. In addition the operation of the EES system could have significant and unmitigable impacts on avian species. The extensive spray systems would create a mist of highly saline water through which birds may fly. Birds flying through this spray would become coated with highly saline water and would ingest significant amounts of salt after preening salt soaked feathers. In addition birds that land in the ponds may become encrusted with salt.

Construction and use of a haul road would affect upland avian species by direct loss of habitat and by noise that would be introduced into areas where upland species feed, nest, and roost. These effects would be mitigable if destruction of habitat is minimized and the road is removed and the footprint is restored to current conditions as quickly as possible.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1 with reduced inflow conditions.

Alternative 5 with Reduced Inflow Conditions

Impacts would be the same as those described above in the current inflow scenario, except that salinity levels would be reduced to 46,175 mg/L from 75,050 under the no action alternative. Although most aquatic prey species can survive at this level, their populations would be stressed. However, there still would be an overall beneficial impact to avian species dependent on the aquatic ecosystem. The Sea level would be lowered by three feet over the 30-year period with little or no impacts to nearshore habitat.

Displacement Dikes. Impacts for the displacement dike would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow flow conditions.

4.7.11 Cumulative Effects

Although there would be site-specific impacts to avian species associated with the construction and operation of select project features, the overall effect of the project on avian resources of the Salton Sea would be beneficial. However, the significant effects on upland species associated with the construction of the concentration ponds and the EES facilities and the losses due to collisions with the EES towers would combine with the effects of other proposed developments in the basin as described in Section 2 of this EIS/SIR to put further pressure on these species.

4.7.12 Mitigation Measures

To mitigate for the impacts due to the haul and construction roads, they would be scarified, plowed, and replanted to native species once construction is completed. To reduce the potential for some species of migrating birds being exposed to salt spray at the EES site radar units would be installed north and south of the site to detect migrating birds so that the system could be shut down when large flocks of migrating birds are detected. In addition air cannons would also be set off when migrating birds are detected to further reduce losses due to collision. Although this would not fully mitigate for losses, for example individual birds or small flocks of migrating birds may not be detected, losses may be significantly reduced. A monitoring plan will be instituted to further refine these mitigation methods.

4.7.13 Significant Unavoidable Impacts

Significant unavoidable impacts to avian species are discussed under the No Action Alternative and alternatives 1, 2, 3, 4, and 5. Loss of upland habitat from the construction of the EES systems and the impacts to upland birds from the loss of feeding and nesting areas is unavoidable and unmitigable. Losses from the collision of migrating birds with the EES towers and pipes and the loss of birds that land in the EES evaporation ponds also cannot be avoided.

4.8 VEGETATION AND WILDLIFE

4.8.1 Summary of Environmental Consequences

Significant and mitigable vegetation and wildlife impacts would occur under the No Action Alternative, Alternative 2, Alternative 3, and Alternative 4 as a result of changes in habitats and incompatibilities between restoration activities and existing resources. Alternatives 1 and 5 would result in less than significant impacts to vegetation and wildlife because the affected area would be much smaller than that of the other alternatives and would be implemented mainly within areas of existing water.

4.8.2 Significance Criteria

Significant vegetation and wildlife impacts would occur if one of the alternatives were to substantially alter the current habitats of the Salton Sea and surrounding areas, affecting forage or cover for wildlife, or in the case of protected species, resulting in direct removal of plants. Criteria used to evaluate the significance of impacts to vegetation and wildlife are derived from the legal (federal and state) requirements to protect special status species and sensitive habitats, as described in Chapter 3. Specific criteria also may take into account issues identified during public scoping of the EIS/EIR, discussions with USFWS and CDFG, and other reports addressing potential impacts of various land uses at Salton Sea on vegetation and wildlife.

An alternative could have significant vegetation and wildlife impacts if its implementation would result in any of the following:

- Harm to, harassment of, or destruction of individuals of any vegetation and wildlife species listed as endangered, threatened, or rare under federal or California law. In addition, such impacts are considered significant to other vegetation and wildlife species under the following conditions:
  - survival and reproduction of a species in the wild are in immediate jeopardy;
  - the species exists in such small numbers throughout all of or a significant portion of its range that it may become endangered if its environment worsens due to the project;
  - the species is likely to become endangered in the foreseeable future and may be categorized as threatened under federal law;
- Modification or destruction of the habitat, travel or dispersion corridors, or reproductive areas of endangered, threatened, rare, or other vegetation and wildlife species as defined in the preceding paragraphs;
- Loss of a substantial number of any vegetation or wildlife species that could affect abundance or diversity of that species beyond normal variability; or
- Measurable degradation of sensitive habitats, such as wetlands and/or other legally protected habitats.

4.8.3 Assessment Methods

Potential impacts to vegetation and wildlife are assessed by comparing proposed changes in habitat use under each of the alternatives to current and planned uses of these same areas. Existing vegetation and wildlife status, as described in Chapter 3, form the basis for assessing the significance of changes to these resources under each of the alternatives.

4.8.4 No Action Alternative

Under the No Action Alternative, significant and unmitigable impacts to vegetation and wildlife would occur. The continued increase in salinity would make the waters more and more uninhabitable for all species that use the Salton Sea. Further concentration of minerals and pollutants may cause direct mortality in those species that spend large amounts of time in or exposed to the waters.

Effect of No Action Alternative with Continuation of Current Inflow Conditions

Significant and unmitigable vegetation and wildlife resource impacts would occur under the No Action Alternative in conjunction with continuation of the current flow conditions. The salinity is expected to increase to over 52,896 mg/L, causing a loss of 348 acres of wetlands that provide habitat for the state endangered California black rail, which is also a federal species of concern and the federally listed as endangered Yuma clapper rail. The wetland plant species may be replaced by more salt-tolerant species, such as tamarisk, which provide little wildlife value.

Effect of No Action Alternative with Reduced Inflows

Significant and unmitigable impacts would be expected under the No Action Alternative with reduced inflows. Under these conditions, Sea level would drop by 9 feet. Effects of this drop would be widespread. The negative effects described above would be made more severe with salinity levels of 75,050 mg/L, which would inhibit any significant revegetation. Impacts would include vegetation losses, including 348 acres of shoreline strand wetlands and an indeterminate amount of adjacent wetlands that depend on Sea water for existence. This habitat is not likely to reestablish itself as the Sea level drops because of high levels of residual salt in the soils. In addition fluctuations in the water levels of the Sea would affect burrowing wildlife or shoreline vegetation. The drop in water level would cause downcutting of the channels of streams flowing into the Sea, thereby draining adjacent wetlands and marsh areas. The loss of some part of these wetlands would further affect species dependent on wetlands, such as the California black rail and Yuma clapper rail.

4.8.5 Alternative 1

Effect of Alternative 1 with Continuation of Current Inflow Conditions

North and South Evaporation Ponds (98kaf/y). Construction and operation of the concentration ponds under Alternative I would result in less than significant impacts to vegetation and wildlife. The evaporation ponds mostly would be constructed in existing open water habitats, thus not affecting most wildlife resources, other than birds and fish (see preceding sections). The dikes that would be constructed in conjunction with the evaporation ponds would extend five miles seaward. This could stagnate wetland areas due to the lack of nutrient replenishment and adequate water circulation. Vegetative species using these areas may become physiologically stressed and less viable. However, this impact would offset by the reduction in salinity levels from 52,896 mg/L to 36,834 mg/L. This reduction also would benefit those wildlife species dependent on aquatic resources.

Pupfish Pond. To maintain this habitat and connectivity between the drains in this area, dikes would be constructed from the north and south ends of the southwest evaporation pond extending to the shoreline, effectively creating a nearshore habitat protection pond between the shore and the evaporation pond. Significant snag habitat on the west side of the New River and the habitat around the mouth of San Felipe Creek would also be protected within this pond. Salinity levels appropriate to maintain conditions suitable for pupfish habitat would be attained by using a pump system, bringing in Salton Sea water to mix with a smaller portion of drain water. Construction of these facilities would preserve critical nearshore habitat for wildlife species using the nearshore habitat.

North Wetland Habitat. The impacts of the North Wetland Habitat would be similar to those described above for the Pupfish Pond.

Effect of Alternative 1 with Reduced Inflows

There would be no impacts to vegetation and wildlife due to Alternative 1 with reduced inflows. Under the reduced inflow scenario, the concentration ponds would be built on lands currently in the Sea, so no impacts would occur. However, as the Sea level drops, the ponds would be left on dry land. The reduction in salinity levels from 75,050 mg/L to 45,862 mg/L would allow for revegetation of the nearshore zone benefiting those species dependent on the Sea.

Displacement Dike. This dike would be constructed in the southern portion of the Sea as shown on Figure 2.4-4. It is designed to essentially reduce the total area of the Sea, effectively displacing enough water to maintain elevations if annual inflows are reduced to 1.06 maf per year. Construction activities for the displacement dike would temporarily disturb approximately 360 on-shore acres, would take approximately 48 months to complete, and would involve a maximum of 300 to 330 workers. This feature would have little long-term effects on wildlife resource using the Sea compared to the no action alternative.

4.8.6 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

EES Located North of Bombay Beach (150 kag/year – Showerline Technology). Construction of the EES north of Bombay Beach would have significant and unmitigable impacts on vegetation and wildlife. Each of these impacts could affect a variety of species, particularly those that use the water and shoreline areas.

The waters within the EES system would likely be highly toxic to wildlife species that come into contact with them due to the highly elevated salinity and contaminants. Species exposed to these waters also would be directly affected, and their reproductive success may be reduced.

Construction of the EES system would result in the direct loss of 7,500 acres of desert habitat and associated vegetation. The area is characterized as creosote bush scrub dominated by creosote bush, burro weed and brittle brush. The impacts that would occur include the direct loss of plants, the local wildlife species that depend on this habitat for food, cover, and reproduction, and the resultant loss of prey base for predator species. Species that may be affected include the flat tailed horned lizard and the western chuckwalla (a species of concern). In addition, the facilities would occupy a large block of land that could hinder migration or foraging patterns of wildlife that range over larger areas, such as deer, puma (a species of concern), and coyote. Because of the scale of land affected mitigation to a less than significant level would not be possible.

Additional direct losses would occur from establishing haul roads and borrow areas needed to construct the retaining dikes associated with the EES system containment ponds. The roads and borrow areas would result in an additional temporary loss of 26 acres of creosote bush habitat.

The EES would provide little long-term beneficial effects over the no action alternative under this scenario to vegetation and wildlife since the Sea's salinity levels under this alternative would only decrease from 52,896 mg/L to 45,510 mg/L.

North Wetland Habitat. The impacts of the displacement dike would be similar to those described under Alternative 1.

Effect of Alternative 2 with Reduced Inflows

The impacts of Alternative 2 with reduced inflows would be similar to those described for Alternative 2 with current inflow conditions. The salinity in the Salton Sea under this scenario would be reduced from 75,050 mg/L to 53,726 mg/L, providing beneficial impacts to vegetation and wildlife that depend on the Sea's viability.

Displacement Dike. The impacts of the displacement dike would be similar to those described under Alternative 1under the low flow conditions.

Import Flood Flows. In addition to those actions described above, Alternative 2 with reduced inflows would include augmenting inflow to the Sea by using flood flows from the Colorado River. Colorado River flood flows are generally available approximately every three to seven years. The flood flows would eventually be released through the Alamo River and Coachella Evacuation Channel. Up to 300,000 acre-feet or a total of 1250 cfs could be available during flood releases over a one to four month period. Release of these high flows over an extended period would cause increased erosion in the Alamo River causing a degradation or loss of wetland habitat impacting wildlife species dependent on that habitat.

4.8.7 Alternative 3

Effect of Alternative 3 with Continuation of Current Inflow Conditions

EES located at the Salton Sea Test Base (150kaf/year) – Showerline technology). Construction of the EES on the former Salton Sea Test Base would alter the habitats in this area. Construction of the EES at this site would affect approximately 7,500 acres of currently undeveloped land. The area is characterized as creosote bush scrub dominated by creosote bush, burro weed and brittle brush. As with the EES at Bombay Beach, significant and unmitigable vegetation and wildlife impacts would occur in conjunction with this project, and these impacts would be similar to those outlined for Bombay Beach.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 MAFY)

As with the EES at Bombay Beach, significant and unmitigable vegetation and wildlife impacts would occur in conjunction with this project, and these impacts would be similar to those outlined for Bombay Beach.

Displacement Dike. Impacts for this facility would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow conditions.

4.8.8 Alternative 4

Effect of Alternative 4 with Continuation of Current Inflow Conditions

South Evaporation Pond (68 kaf/year) and an EES located at Salton Sea Test Base (100 kaf/year – Showerline Technology. Construction of the concentration ponds and the EES at the former Salton Sea Test Base would result in significant and unmitigable vegetation and wildlife impacts, which would be the similar to the combined impacts described above under alternatives 1 and 3. The combined effects of potential resource damages from the EES and concentration ponds under Alternative 4 would be more severe than those under the No Action Alternative and alternatives 1, 2, and 3. A total of 7,500 acres of desert habitat would be permanently lost, and 306 acres would be temporarily lost. The area is characterized as creosote bush scrub dominated by creosote bush, burro weed and brittle brush.

The beneficial impacts of this alternative would be the reduction in the salinity levels from 52,896 mg/L to 39,566 mg/L providing beneficial impacts to vegetation and wildlife that depend on the Sea's viability.

Pupfish Pond. The impacts of the pupfish pond would be similar to those described under Alternative 1under the low flow conditions.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1.

Effect of Alternative 4 with Reduced Inflows

Construction of the concentration ponds and the EES at the Salton Sea Test Base would result in significant and unmitigable vegetation and wildlife impacts. Impacts would be the same as those described above under alternatives 1 and 3. The combined effects of potential resource damages from the EES and concentration ponds under Alternative 4 would be more severe than those under the No Action Alternative and alternatives 1, 2, and 3. Salinity levels would be reduced from 75,050 mg/L to 47,467 mg/L providing beneficial impacts to vegetation and wildlife that depend on the Sea's viability.

Displacement Dike. Impacts for this facility would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow flow conditions.

4.8.9 Alternative 5 with Continuation of Current Inflow Conditions

EES Located Within the North Evaporation Pond (150 kaf/year EES – Ground Mounted Spray Technology. Under Alternative 5, EES would be constructed within the north evaporation pond and ground mounted spray units would replace the tower and showerline units proposed for Alternatives 2 and 3. Construction and operation of the concentration ponds under Alternative 5 would result in significant and mitigable impacts to wildlife and vegetation, the result of direct loss of habitat due to construction activities. Beneficial impacts would occur to species dependent upon the Salton Sea, as the operation of the ponds would reduce the salinity levels to 40,841 mg/L compared to 52,896 mg/L under no action conditions. Aquatic resources are expected to significantly benefit by this reduced salinity which would benefit those wildlife species dependent on the aquatic ecosystem of the Sea.

The level of the Salton Sea would drop by approximately 9 feet significantly impacting nearshore habitat. Approximately 600 acres of this habitat would be lost and the impacts would be similar to those described under the No Action Alternative under low flow conditions.

Construction and use of a haul road would affect wildlife species by direct loss of habitat, disruption of migratory patterns, and by noise that would be introduced into upland habitat areas. These effects would be mitigable if destruction of habitat is minimized and the road is removed and the footprint is restored to current conditions as quickly as possible.

North Wetland Habitat. Impacts for the North Wetland Habitat would be similar to those described under Alternative 1 with reduced inflow conditions.

4.8.10 Alternative 5 with Reduced Inflow Conditions

Impacts would be the same as those described above in the current inflow scenario, except that salinity levels would be reduced to 46,175 mg/L from 75,050 under the not action alternative. Although most aquatic prey species can survive at this level, their populations would be stressed. However, there still would be an overall beneficial impact to wildlife species dependent on the aquatic ecosystem. The Sea level would be lowered by three feet over the 30-year period with little or no impacts to nearshore habitat.

Displacement Dikes. Impacts for the displacement dike would be similar to those described under Alternative 1 with reduced inflow conditions.

Import Flood Flows. The impacts of the import flood flow feature would be similar to those described under Alternative 2 with reduced inflow flow conditions.

4.8.11 Cumulative Effects

There would be little cumulative effects on the vegetation and wildlife from constructing the concentration ponds and other proposed project features, except for the EES. However, the significant effects on vegetation and associated wildlife that would occur from constructing the concentration ponds and the EES which would combine with the effects of other proposed developments in the basin to put further pressure on these resources.

4.8.12 Mitigation Measures

Critical habitats in the vicinity of the Salton Sea would not be adversely affected by project activities under the alternatives due to their locations away from affected areas. These habitats include desert fan palm oasis woodland and various stages of desert dunes. However, some vegetation species may be displaced or physiologically stressed due to project activities. Mitigation measures for these species are described here.

- Enhance adjacent areas to serve as supplemental habitats/potential areas for expansion;
- create new suitable areas to serve as locations for the vegetation species to exist;
- avoid vegetation and habitats where possible during construction, material transport, dumping, and borrow activities; and
- place the haul road so that it causes minimal disturbance to existing biological resources.

Construction and operation of facilities associated with the proposed alternatives may adversely affect some wildlife species. In order to mitigate for any impacts, the following are proposed:

- Avoid habitats and areas known to be important to area wildlife where possible;
- restore any disturbed habitats or critical areas;
- introduce supplemental habitat components, such as artificial burrows and cover, to provide adequate resources for potentially displaced individuals;
- relocate wildlife species found in areas potentially affected by construction and operation of the facilities, including those individuals occurring near roads and thoroughfares where possible;
- establish an active monitoring program to assess wildlife conditions during and after project implementation, to also include impacts from noise;
- construct fencing or other barriers to prevent wildlife from entering hazardous areas or environments, such as the potentially toxic concentration ponds with care taken to avoid impacting local and regional migration patterns; and
- restore to the extent possible temporary construction roads, haul roads, and borrow area.

4.9 SOCIOECONOMICS

4.9.1 Summary of Environmental Consequences

The No Action Alternative would result in adverse socioeconomic impacts from the increase in salinity, change in Sea elevation, and potential increase in wildlife mortality and eutrophic conditions. These conditions would eventually lead to further declines in the number of visitors, which, in turn, would reduce visitor spending. Declining visitors and spending would lead to declines in employment and property values, both in the immediate vicinity of the Sea and in surrounding areas, most notably in Imperial County.

Construction of any of the restoration alternatives would result in positive short-term economic impacts from increased employment, spending, and business transactions. Principal direct effects on employment in Imperial County or central Riverside County would be from hiring local workers for hauling and other construction work. Additional indirect employment and earnings would also be expected as a result of increased area employment and expenditures. There could be temporary impacts to housing because about 80 percent of construction workers are anticipated to come from outside the region. Current housing vacancy, land zoned for development, and temporary facilities (e.g., hotels and apartments) have sufficient capacity to accommodate the workers, so the impact is not expected to be significant. The common actions that would be implemented with each alternative, including fish harvesting, improvements to recreation facilities, shoreline cleanup, and wildlife disease control, would have immediate beneficial impacts on the area.

Within the restoration stage (next thirty to forty years), employment and expenditures of the restoration program would have a small positive effect on the local economy. The staff of restoration facilities would take up residence in the Coachella-Imperial area, adding slightly to local employment, population, retail activity, tax base, and housing demand. In addition, the increased employment and expenditures would generate additional indirect employment.

Over the long-term, there is the possibility of large-scale positive effects from shoreline- and recreational-based developments. The magnitude of the effects would depend on each alternative's capacity to achieve target levels for Sea water salinity and Sea elevation.

4.9.2 Significance Criteria

For purposes of this analysis, the following conditions are assumed to indicate that social and economic effects would be significantly adverse.

Regional Economics. If the construction or operation of the project leads to reduction in total employment beyond rates of historic variation.

Public finance. If the project necessitates public service expenditures substantially in excess of revenues.

Demography and housing. If the project displaces or otherwise necessitates the relocation of a substantial number of existing residents, generates housing demand substantially in excess of what is available, or disrupts community cohesion and interaction.

4.9.3 Assessment Methods

The project alternatives and related actions may affect social and economic conditions of areas near the Sea. These areas may be classified into the area immediately adjacent to the Sea and the local area that has a substantial economic relationship with the Sea. For purposes of this analysis, the former is considered as including up to three to five miles from the shore at the Sea's existing elevation (-227 ft. msl), and the latter is considered as consisting of both Coachella Valley in Riverside County and all of Imperial County.

There is also the multicounty, southern California region, within which the Sea's economic area is located and from which many of the construction workforce would originate. At this scale, however, project impacts would be very diffuse and hence are not addressed in this study.

Social and economic effects are described under the following headings:

Regional Economics. Employment, wages, other program expenditures, and indirect effects, including effects on recreation and visitor industries and associated commercial and residential development;

Public Finance. Fiscal impact on local jurisdictions and public agencies;

Demography and Housing. Impact on resident population and housing.

Phase 1 alternatives would be implemented over twenty-three or more years following initial construction of the facilities. In order to account for potentially different effects over time, Phase 1 alternatives are analyzed over the following stages:

Construction Stage. Construction of an evaporation pond or enhanced evaporation system is anticipated to require from three to four years (approximately 2003 to 2007). Construction activities would primarily affect social and economic conditions in this period. Common actions would be implemented at the beginning of the construction period for each alternative. These include fish harvesting, improvements to recreation facilities, shoreline cleanup, and wildlife disease control. Additional construction could be required after the primary construction period due to facilities necessitated by reduced inflows.

Restoration Stage. After completion, an evaporation pond would be operated for thirty years, then closed. An enhanced evaporation system would be operated for 100 years but would require approximately forty years to achieve a satisfactory stabilized level of salinity in the Sea. Social and economic effects in the period from approximately 2007 to 2050 would accrue primarily from restoration activities. Depending on inflow conditions, certain Phase 2 actions would be initiated during this stage.

In the long term, successful implementation of the restoration alternatives could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

4.9.4 No Action Alternative

Under the No Action Alternative with continuation of the current inflows or with reduced inflows, there would be adverse socioeconomic effects from the deterioration in water quality and the eventual loss of wildlife. Impacts include a decline in recreational use of the Sea and related commercial activities, reduced employment and property values, and degraded quality of life indices (such as ecological and social values).

Effect of No Action Alternative with Continuation of Current Inflow Conditions

The number of recreational visitors to the Sea has declined greatly from peak levels (Table 3.12-1). While visitor counts have increased lately as a result of the resurgence of corvina sportfishing, this resurgence cannot be expected to last under the No Action Alternative. Eventually, declining visitors and spending also could lead to lower property values, both in the immediate vicinity of the Sea and in surrounding areas.

Apart from declining, purely human (market) economic values derived from the Sea, the No Action Alternative also would lead to a decline in the ecological value of the Sea. The Sea's current role as a stop on the Pacific Flyway bird migration route provides an important contribution to the functioning of the North American ecosystem. This, in turn, provides environmental and economic benefits to the whole continent. The No Action Alternative would place these benefits at risk and eventually could require costly reconstruction of alternative facilities.

Effect of No Action Alternative with Reduced Inflows

The impacts of the No Action Alternative under current and reduced inflows would be similar; however, the adverse effects would be realized sooner under reduced flow conditions. In addition, reduced inflows would result in a drop of Sea elevation, thereby making many piers and other shoreline facilities unusable.

4.9.5 Alternative 1

When combined with Phase 2 actions of water export or import, the two evaporation ponds proposed under this alternative could achieve the target salinity level of 40,000 ml/L around 2025 or 2035, depending on the level of inflow. Construction of the ponds would also have short term positive economic impacts to the local communities.

Effect of Alternative 1 with Current Inflow Conditions

Regional Economics. The construction and operation of evaporation ponds are likely to result in positive economic effects on the Imperial and southern Coachella valleys. The Bureau of Reclamation estimates total construction costs of the ponds to be approximately $460 million over four years. Positive effects include increased spending for wages of workers from the local area and increased profits to local material suppliers and service providers. The Bureau of Reclamation estimates that construction would require a total of 440 employees annually, many of whom would be workers from outside the area. Due to the temporary nature of construction activity, it is not expected that any significant secondary employment would be induced.

The Bureau of Reclamation estimates that operation and maintenance of the pond is would cost an average of $1.6 million annually and would employ less than 5 people. This would have minor positive impacts in the region, and could generate negligible induced employment.

In the long term, successful restoration could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

Public Finance. During construction, the project would create an increased need for public services, such as public safety. However, increased use of area hotel/motel, restaurant, and retail facilities by construction workers from outside the area should result in sufficient increase in local tax revenues to finance the additional services. Similarly, the cost of any additional public services required during the 30-year operation of the ponds would likely be offset by taxes either directly (e.g., sales tax) or indirectly (e.g., property tax covered by rent) paid by the workers.

Over the long term, if recreational use of the Sea increases substantially, then the need for public services also would increase. However, commercial uses tend to generate greater tax revenues than would be needed to provide additional public services, and the net fiscal impact likely would be positive.

Demographics and Housing. Construction could have a negative, but nonsignificant, impact on local housing. Most of the construction workforce is expected to come from outside the Coachella-Imperial area and would require temporary housing. These needs could be easily accommodated by local hotel and motel facilities.

Over the long term, if recreational and commercial activities increase as a result of improving the Sea's water quality, there may be increases in resident population and housing. The extent and timing of these impacts, however, depend on factors and conditions which are unrelated to this alternative or which cannot be foreseen. These impacts are not considered to be significant.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

The reduced flow conditions would necessitate increased construction activities, including the Displacement Dike and Southeast and North Shorebird Ponds. This would increase the construction costs by over $450 million and would require an additional 300 construction workers per year. Therefore, impacts from the construction phase would be slightly greater than for Alternative 1 with current inflow conditions. In addition, there would be a slight increase in the annual cost of operation and maintenance.

4.9.6 Alternative 2

Construction of the EES east of Bombay Beach would not result in any significant socioeconomic impacts. Construction and operation of the facilities would result in net positive economic impacts; however, there would be adverse social impacts from the relocation of residents at the project site.

Effect of Alternative 2 with Current Inflow Conditions

Regional Economics. Construction of the EES would have short-term beneficial impacts to regional economics and employment. The Bureau of Reclamation estimates total construction costs of the EES to be approximately $335 million over three years. Positive effects include increased spending for wages of workers from the local area and increased profits to local material suppliers and service providers. The Bureau of Reclamation estimates that construction would require a total of 260 employees annually, many of whom would be workers from outside the area. Due to the temporary nature of construction activity, it is not expected that any significant secondary employment would be induced.

The Bureau of Reclamation estimates that operation and maintenance of the EES would cost an average of $9.1 million annually and would employ approximately 70 people. This would have minor positive impacts in the region, and could generate minor induced employment.

In the long term, successful restoration could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

Public Finance. As in the case of Alternative 1, construction activities would create an increased need for public services, but service costs likely would be offset by increased tax revenues from the use of hotel/motel, restaurant, and retail facilities. Over the long term, if recreational use of the Sea increases substantially, then the need for public services also would increase. However, commercial uses tend to generate greater tax revenues than would be needed to provide additional public services, and the net fiscal impact likely would be positive.

Demography and Housing. As in the case of Alternative 1, construction workers would require temporary housing, which could be accommodated by local hotel and motel facilities.

Over the long term, if recreational and commercial activities increase as a result of improving the Sea's water quality, there may be increases in resident population and housing. The extent and timing of these impacts depend on factors and conditions which are unrelated to this alternative or which cannot be foreseen. These impacts are not considered to be significant.

Portions of the Bombay Beach site contain residential developments. Implementing Alternative 2 would require relocating the residents, resulting in an adverse social impact. Fair compensation would be paid for existing housing and for relocation costs; therefore, this is not considered a significant impact.

Effect of Alternative 2 with Reduced Inflow Conditions

The reduced flow conditions would necessitate increased construction activities, including the Displacement Dike and Southwest and North Shorebird Ponds. This would increase the construction costs by over $450 million and would require an additional 300 construction workers per year. Therefore, impacts from the construction phase would be slightly greater than for Alternative 1 with current inflow conditions. In addition, there would be a slight increase in the annual cost of operation and maintenance.

4.9.7 Alternative 3

Construction of the EES at the Salton Sea Test Base site would not result in any significant socioeconomic impacts. Construction and operation of the facilities would result in net positive economic impacts.

Effect of Alternatives 3 with Current Inflow Conditions

Regional Economics. Construction of the EES would have short-term beneficial impacts to regional economics and employment. The Bureau of Reclamation estimates total construction costs of the EES to be approximately $430 million over three years. Positive effects include increased spending for wages of workers from the local area and increased profits to local material suppliers and service providers. The Bureau of Reclamation estimates that construction would require a total of 260 employees annually, many of whom would be workers from outside the area. Due to the temporary nature of construction activity, it is not expected that any significant secondary employment would be induced.

The Bureau of Reclamation estimates that operation and maintenance of the EES would cost an average of $9.5 million annually and would employ approximately 70 people. This would have minor positive impacts in the region, and could generate minor induced employment.

In the long term, successful restoration could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

Public Finance. Construction activities would create an increased need for public services, but service costs likely would be offset by increased tax revenues from the use of hotel/motel, restaurant, and retail facilities, as discussed in Alternative 2

Demography and Housing. As in the case of Alternative 2, construction workers would require temporary housing, which could be accommodated by local hotel and motel facilities. Over the long term, if recreational and commercial activities increase as a result of improving the Sea's water quality, there may be increases in resident population and housing. The extent and timing of these impacts depend on factors and conditions which are unrelated to this alternative or which cannot be foreseen. These impacts are not considered to be significant.

Effect of Alternative 3 with Reduced Inflow Conditions
The impacts would be the same as discussed for Alternative 2 with reduced inflow conditions.

4.9.8 Alternative 4
Construction of the EES in conjunction with an evaporation pond on the southwest shore would not result in any significantly adverse socioeconomic impacts. As with Alternatives 1, 2 and 3, construction and operation of the facilities may result in net positive economic impacts.

Effect of Alternative 4 with Continuation of Current Inflow Conditions
Regional Economics. The Bureau of Reclamation estimates total construction costs of the ponds and EES to be approximately $580 million over four years. Positive effects include increased spending for wages of workers from the local area and increased profits to local material suppliers and service providers. The Bureau of Reclamation estimates that construction would require a total of 370 employees annually, many of whom would be workers from outside the area. Due to the temporary nature of construction activity, it is not expected that any significant secondary employment would be induced.

The Bureau of Reclamation estimates that operation and maintenance of the pond and EES would cost an average of $7.1 million annually and would employ approximately 36 people. This would have minor positive impacts in the region, and could generate minor induced employment.

In the long term, successful restoration could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

Public Finance. As for Alternatives 1 through 3, construction activities would create an increased need for public services, but service costs likely would be offset by increased tax revenues from the use of hotel/motel, restaurant, and retail facilities. Over the long term, if recreational use of the Sea increases substantially, then the need for public services also would increase. However, commercial uses tend to generate greater tax revenues than would be needed to provide additional public services, and the net fiscal impact likely would be positive.

Demography and Housing. The impacts would be the same as discussed for Alternative 1.

Effect of Alternative 4 with Reduced Inflow Conditions

The reduced flow conditions would necessitate increased construction activities, including the Displacement Dike and North Shorebird Pond. This would increase the construction costs by over $450 million and would require an additional 300 construction workers per year. Therefore, impacts from the construction phase would be slightly greater than for Alternative 4 with current inflow conditions. In addition, there would be a slight increase in the annual cost of operation and maintenance.

4.9.9 Alternative 5

Construction of the EES in the northwest evaporation pond and the joint use of the two facilities would not result in any significant impacts to socioeconomic conditions. Most socioeconomic impacts would be similar to those in Alternatives 1 through 4.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Regional Economics. The Bureau of Reclamation estimates total construction costs of the EES and pond to be approximately $405 million over four years. Positive effects include increased spending for wages of workers from the local area and increased profits to local material suppliers and service providers. The Bureau of Reclamation estimates that construction would require a total of 370 employees annually, many of whom would be workers from outside the area. Due to the temporary nature of construction activity, it is not expected that any significant secondary employment would be induced.

The Bureau of Reclamation estimates that operations and maintenance of the pond would cost an average of $6.4 million annually and would employ approximately 36 people. This would have minor positive impacts in the region, and could generate minor induced employment.

In the long term, successful restoration could lead to increased recreational use of the Sea, which would spur development in the area and lead to additional positive economic impacts in the area, including increased employment.

Public Finance. Effects under this alternative are similar to those of Alternatives 1 through 4. Specifically, costs of additional public services needed during construction, restoration, and post-restoration stages of project implementation are likely to be offset by increased tax revenues, particularly if recreational and commercial activities near the Sea increase as a result of improvements in water quality.

Demography and Housing. Effects under this alternative are similar to those of Alternatives 1, 3 and 4.

Effect of Alternative 5 with Reduced Inflow Conditions

This alternative would have impacts similar to those discussed for Alternatives 1 through 4.

4.9.10 Cumulative Effects

Other projects and planned projects in the region could have minor cumulative effects on the local socioeconomic environment. Most of these would be beneficial effects from increased economic development in the two counties (e.g., gold mine expansion and class three landfill development). No projects are known within the planning horizon that would result in significant adverse cumulative socioeconomic impacts.

If annual inflow to the Sea were reduced below current flows from other actions (e.g., 4.4 Plan), the Sea's elevation would decline. This could result in a receding shoreline, rendering most current piers and other shoreline facilities unusable. However, with the timely implementation of Phase 2 actions, the Sea elevation would temporarily decline to a level no lower than approximately -237 feet msl. Since all alternatives would ultimately achieve the target levels of salinity and elevation, with consequent economic benefits of restoration, the temporary, negative impacts of changes in Sea elevation are not considered to be significant.

4.9.11 Mitigation Measures

Any residential relocation that may be required by the construction of EES near Bombay Beach (Alternative 2) would occur in accordance with federal and state guidelines for relocation and with compensation of full market value. None of the other action alternatives would result in significant adverse impacts; hence mitigation measures are not required.

4.9.12 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant, unavoidable, adverse impacts to social or economic conditions of areas near the Sea.

4.10 LAND USE AND PLANNING

4.10.1 Summary of Environmental Consequences

For the No Action Alternative with continuation of existing inflows, there would be few direct effects on land use. Significant land use impacts would occur under the No Action Alternative and all restoration alternatives with reduced inflows because large land areas would be exposed by reductions in the surface elevation of the Sea. During Phase 1, the least land exposure would occur under the No Action Alternative.

Alternatives 1 and 5 would result in less than significant impacts to on-shore land use since the affected areas would be relatively small, and most on-shore disturbance would be temporary. Significant land use impacts would occur under alternatives 2, 3, and 4 because of incompatibilities between restoration activities and existing land use plans. All restoration alternatives also would have indirect effects that could be considered beneficial to land use in that the value of areas designated for residential, urban, and recreational uses would be greatly enhanced.

4.10.2 Significance Criteria

Significant land use impacts would occur if land use changes associated with an alternative would conflict with adopted land use plans or policies in affected jurisdictions.

4.10.3 Assessment Methods

Existing land uses, as described in Chapter 3, form the basis for assessing the significance of changes in land use under each of the alternatives. Potential impacts to land use were assessed by comparing proposed changes in land use under each of the alternatives to current and planned uses of these and the surrounding areas. Applicable land use planning documents are described in Chapter 3.

4.10.4 No Action Alternative

Under the No Action Alternative with a continuation of the current inflow conditions there would be no direct effects on existing land use. Under the No Action Alternative with reduced inflows, significant impacts to land use would be expected. Under either scenario, potential indirect land use impacts may result from continued degradation of the Sea.

Effect of No Action Alternative with Continuation of Current Inflow Conditions

No significant land use impacts would occur under the No Action Alternative and with a continuation of the current flow conditions. The level of the Salton Sea would be expected to remain relatively constant under these conditions and although minor variations in elevation may occur, adjacent land uses would not be significantly impacted since variations would be comparable to historic conditions.

Rising salinity levels under the No Action Alternative may affect the economic viability of the area, which may indirectly result in alterations in land use patterns. These effects would be expected to be diffuse and limited in area, and would not be considered significant.

Effect of No Action with Reduced Inflows (1.06 maf/yr)

Significant impacts would be expected under the No Action Alternative with reduced inflows. By the end of Phase 1, if the average inflow to the Sea is reduced to 1.06 maf/yr, the level of the Salton Sea would be expected to drop by approximately 7 feet from its current elevation and approximately 37 square miles of submerged lands would become exposed. This effect may be beneficial to owners of land that was submerged by the Sea, such as the Torres Martinez Tribe. Nevertheless, the overall effect of a large decrease in Sea level would be negative because current land use patterns and land use planning around the Sea are based on a relatively constant Sea level at approximately the current elevation. A substantial drop in Sea level leading to large new land areas would alter the current land use patterns and significantly impact current land use planning around the perimeter of the Sea.

4.10.5 Alternative 1

Alternative 1 would not have any significant land use impacts unless the average inflow to the Sea is reduced. There would also be beneficial land use effects associated with restoration of the Sea and stabilization of surface elevation. With reduced inflow conditions, the effects of Alternative 1 would be less severe than the effects of the No Action Alternative with reduced inflows.

Effect of Alternative 1 with Continuation of Current Inflow Conditions

Construction and operation of the north and south evaporation ponds, and the pupfish pond under Alternative 1 would result in less than significant land use impacts. The construction of the ponds would occur within the Sea and, although inundated land under a variety of ownership would be affected, construction of the ponds would be a use compatible with the current and planned uses of the Salton Sea. In addition, inundated lands are not part of current land use planning or use and therefore the impact to these lands would be less than significant.

Approximately 280 acres of on-shore area would be temporarily affected by construction activities, including areas for storage and staging of construction equipment, a borrow area for construction materials, and a haul road extending from the borrow areas south to approximately the Salton Sea Test Base. The potentially affected area would include private land, land administered by the US Navy and BLM, land withdrawn by Reclamation, and land belonging to the Torres Martinez Tribe. Affected area in Imperial County may include land designated as open space, urban, government, and agriculture. Permitted uses in open space areas include limited recreation, single-family, and residential. Permitted land uses in the West Shores/Salton City Urban Area range from recreation/open space to high-density residential and commercial uses (Imperial County 1997). Permitted uses on government land (Salton Sea Test Base) are discussed below.

In Riverside County, land uses potentially affected by construction activities include desert and planned residential reserve areas. Permitted uses in the desert areas are limited recreation, limited single-family residential, landfill, compatible resource development, or governmental uses. Planned residential reserve areas are areas set aside for future, large-scale residential development. Commercial uses to support residential development, recreation, and open space, also are permitted uses in the residential reserve areas (Riverside County 1995).

Land use on Torres Martinez Tribal lands is under the authority of the tribe. Although the counties do not have planning authority for tribal lands, they are generally designated as recreation/open space and urban land by Imperial County and agriculture and open space land by Riverside County. The land use plan for Torres Martinez Tribal lands was not available for review at the time of publication of this EIS/EIR. Nevertheless, the Tribe is an active member of the long-term management team for the Salton Sea and all actions on tribal lands would be necessarily be developed with input from the tribe to ensure it is consistent with the land use plan. Effects on tribal lands are discussed in Section 4.17, Indian Trust Assets.

Direct changes in land use under this alternative would be temporary and therefore would not conflict with the planned land uses in either county or on tribal lands.

Temporary construction activities may be a compatible use on the former Salton Sea Test Base since military uses have ceased. In addition, temporary construction activities would be compatible with the Class L (Limited Use) designation of the lands specified in the management plan proposed by BLM, USFWS, and Reclamation for post-conveyance management of the property. BLM lands that may be affected are unclassified (BLM 1981) and interim use for construction activities would be a compatible use.

Long-term indirect impacts to land use also may occur from Sea level stabilization and salinity control. Success of restoration activities may improve the economic viability of the area, and land use patterns may be altered. The value of land designated for residential, urban, and recreation could substantially increase and become better suited to its intended uses. It is assumed that land use changes in response to economic improvement would be developed consistent with existing land use plans and would be beneficial.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

Significant land use changes could occur if inflows are reduced during Phase 1 to 1.06 maf/yr. During Phase 1, the effects would be more severe under Alternative 1 with reduced inflows than under the No Action Alternative with reduced inflows. As discussed for the No Action Alternative, the overall effect of a large decrease in Sea level would be negative because current land use patterns and planning are based on a relatively constant Sea level at approximately the current elevation. Under Alternative 1, the area exposed at the end of the Phase 1 planning period (2030) is projected to be 95 square miles, compared to 37 square miles that would be exposed under the No Action Alternative with reduced inflow.

Construction of the displacement dike under reduced inflow conditions would require extension of the haul road. An additional 175 acres of on-shore area would be temporarily affected by this construction, consisting mostly of agricultural lands in the Imperial Valley. Land use changes would be temporary and therefore would not conflict with planned land uses. In-Sea construction of the displacement dike would affect inundated lands but this impact would be less than significant.

4.10.6 Alternative 2

Construction of the EES north of Bombay Beach would be incompatible with planned land uses in the area. There would be adverse effects associated with exposure of lands from reduced water surface elevations under reduced inflow conditions. There also may be beneficial land use effects associated with restoration of the Sea.

Effect of Alternative 2 with Continuation of Current Inflow Conditions

Construction of the EES system north of Bombay Beach would result in significant land use impacts. The industrial nature of the EES would be incompatible with current and planned uses in the area.

Construction of the EES would require development on approximately 4,200 acres of currently undeveloped land; approximately 2,500 acres are privately held and approximately 1,700 acres are public lands administered by BLM. Private lands would be acquired in-fee, while BLM lands required for development would be withdrawn by Reclamation. Approximately 1,200 acres are within Riverside County and 3,000 acres are within Imperial County.

Lands within Riverside County are a checkerboard pattern of private and BLM lands. Private landholdings are designated as desert lands in the Riverside County General Plan. Development of the EES facility would be inconsistent with the current and planned uses in this area, which include limited recreation, limited single-family residential, landfill, compatible resource development, or governmental uses (Riverside County 1995). BLM landholdings in this area are unclassified in the CDP (BLM 1981). Under this designation, development of the EES may be a suitable land use.

Potentially affected land within Imperial County is a mixture of private and public ownership. Private lands are designated as recreation/open space under the Imperial County General Plan. Development of the EES facility would be inconsistent with the current and planned uses in this area, which include recreation, natural resource preservation, and protection from environmental hazards (e.g., recreational vehicle parks, resource conservation, and floodplains) (Imperial County 1997). BLM landholdings in this area are unclassified in the CDP (BLM 1981) and may be suitable for EES development.

Long-term beneficial impacts, as described above under Alternative 1, also may occur under this alternative as residential, urban, and recreational land may become better suited for these planned uses.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Significant land use changes would occur if inflow is reduced to 1.06 maf/yr. As discussed for the No Action Alternative, the overall effect of a large decrease in Sea level would be negative because current land use patterns and planning are based on a relatively constant Sea level at approximately the current level. The effects would be more severe under Alternative 2 with reduced inflows than under the No Action Alternative with reduced inflows. With reduced inflow conditions, the area exposed at the end of Phase 1 is projected to be 70 square miles under Alternative 2, compared to 37 square miles under the No Action Alternative. Construction of the haul road under this alternative would not significantly affect land use, as described above under Alternative 1.

4.10.7 Alternative 3

Constructing the EES within the former Salton Sea Test Base would be incompatible with current and planned land uses. Adverse effects associated with exposure of lands from reduced water surface elevations may occur from reduced inflow conditions. Beneficial land use effects also may be associated with restoration of the Sea.

Effect of Alternative 3 with Continuation of Current Inflow Conditions

Constructing the EES on the former Salton Sea Test Base would result in significant land use impacts. As described above under Alternative 1, in-Sea construction of the pupfish pond would result in less than significant land use impacts.

Construction of the EES at this site would convert approximately 4,200 acres of currently undeveloped land in Imperial County (the same area as would be required for development of the EES north of Bombay Beach). Most land to be used for the EES would be within the former Salton Sea Test Base is administered by the US Navy. The base is closed and in the process of disposal in accordance with the Base Realignment and Closure Act (BRAC) of 1988. Final decisions on disposal have not been made and cleanup and restoration activities prior to disposal are ongoing. Long-term land use planning for the base will not be finalized until the base closure process has been completed. Construction of the EES on this property would conflict with current military land use as well as land use planning under an integrated resource management plan (IRMP) developed by BLM, USFWS, and Reclamation, and approved by BLM, which provides for management of these lands as wildlife habitat (US Navy 1996).

Additional BLM lands west of Highway 86 are unclassified under the CDP (BLM 1981). Under this designation, developing the EES may be a suitable land use. Private landholdings in the area are within Imperial County and are designated as recreation/open space. Developing the EES facility would be inconsistent with the current and planned uses in this area, which are primarily related to recreation, natural resource preservation, and protection from environmental hazards (e.g., recreational vehicle parks, resource conservation, and floodplains) (Imperial County 1997).

Long-term beneficial impacts, as described above under Alternative 1, also may occur under this alternative as residential, urban and recreational land become better suited for the intended uses.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflows would be the same as those discussed for Alternative 2.

4.10.8 Alternative 4

Construction of the south evaporation pond and the EES at the former Salton Sea Test Base would result in significant land use impacts similar to those discussed for alternatives 2 and 3.

Effect of Alternative 4 with Continuation of Current Inflow Conditions

Land use impacts associated with constructing the south evaporation pond and the pupfish pond would be comparable to that described under alternatives 1, 2, and 3. The effect of construction and operation of the EES at the former Salton Sea Test Base would be the same as discussed for Alternatives 3. The long-term beneficial effects of restoration would be the same as those discussed for other alternatives.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

Significant land use changes could occur if inflows are reduced during Phase 1 to 1.06 maf/yr. The effect would be greater under Alternative 4 with reduced inflows than under the No Action Alternative with reduced inflows. As discussed for the No Action Alternative, the overall effect of a large decrease in Sea level would be negative because current land use patterns and planning are based on a relatively constant Sea level at approximately the current level. With reduced inflow, the area exposed at the end of Phase 1 is projected to be 80 square miles under Alternative 4, compared to 37 square miles under the No Action Alternative. Construction of the haul road under this alternative would not significantly affect land use, as described above under Alternative 1.

4.10.9 Alternative 5

Construction of the north evaporation pond in combination with the EES system would be incompatible with surrounding land uses and would result in a significant impact.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Construction of the north evaporation pond, the EES within the evaporation pond, and the pupfish pond, would occur within the Sea and, although inundated land under a variety of ownership would be affected, construction of the ponds would be compatible with the current and planned uses of the Salton Sea. In addition, inundated lands are not part of current land use planning or use and therefore the impact to these lands would be less than significant. Nevertheless, the industrial nature of the EES system would be incompatible with current and planned land uses and would result in a significant land use impact.

Construction impacts would be similar to those described under Alternative 1. The long-term beneficial effects of restoration would be the same as those discussed for other alternatives.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Significant land use changes could occur if inflows are reduced during Phase 1 to 1.06 maf/yr. The effect would be greater under Alternative 5 with reduced inflows than under the No Action Alternative with reduced inflows. As discussed for the No Action Alternative, the overall effect of a large decrease in Sea level would be negative because current land use patterns and planning are based on a relatively constant Sea level at approximately the current level. With reduced inflow, the area exposed at the end of Phase 1 is projected to be 75 square miles under Alternative 5, compared to 37 square miles under the No Action Alternative. Construction of the haul road under this alternative would not significantly affect land use, as described above under Alternative 1.

4.10.10 Cumulative Effects

As discussed in Chapter 2 of this EIS/EIR, a number of regional projects could have long-term effects on the average annual inflow to the Sea (see Table 2.7-1). Likewise, a number of other processes could have long-term effects on the future inflows, including changes to agriculture practices, competing demands for water, and natural climatic adjustments. The most likely result of these processes is that future inflows to the Sea could be lower than current conditions. For analysis purposes, inflow is assumed to be reduced to an average annual value of 1.06 maf/yr during the Phase 1 planning period. The effects of such an inflow reduction on land use have been discussed for each alternative.

Other projects could have minor cumulative effects on land use when combined with restoration of the Salton Sea. For example, development of the Mesquite Regional Landfill and expansion of the Gold Field Mine would convert small areas of open space to industrial uses. Within the context of the Salton Basin, these areas and effects would be minor and would not alter the conclusions about land use discussed above for each alternative. Likewise, no other projects are known within the planning horizon that would significantly add cumulative effects to those that are discussed for each alternative.

4.10.11 Mitigation Measures

Actions under alternatives 2, 3, and 4 would be inconsistent with current land use planning for the affected areas. Development of either alternative would require amending these planning guidelines. Nevertheless, the scale and the industrial nature of the proposed land use would be inconsistent with planning policies and surrounding land use and could not be mitigated to a less than significant level. No mitigation measures are feasible.

4.10.12 Potentially Significant Unavoidable Impacts

The development of large areas for restoration facilities and the potential reduction in Sea level would occur under the No Action Alternative, Alternative 2, Alternative 3, and Alternative 4 and would result in significant and unavoidable impacts to land use. No mitigation measures are identified in the EIS that would reduce these impacts to a less than significant level.

4.11 AGRICULTURAL RESOURCES

4.11.1 Summary of Environmental Consequences

Agriculturally important farmland and agricultural productivity would not be significantly affected under any of the Phase 1 alternative restoration actions.

4.11.2 Significance Criteria

Significant impacts to agricultural resources would occur if one of the alternatives were to directly or indirectly result in conversion of agriculturally important farmland to nonagricultural uses. The significance of the agricultural land conversion is determined using the land evaluation and site assessment methodology (LESA) discussed below.

4.11.3 Assessment Methods

Agricultural land conversion is assessed by comparing the footprint of the areas of disturbance or conversion under each alternative to mapped areas of agricultural importance (Figure 3.11-1). Federal agencies are required to consider the significance of the potential agricultural land conversions by the Farmland Protection Policy Act (FPPA) (Pub. L. 97-98) of 1981. If no agriculturally important farmland is to be converted to non-agricultural uses, FPPA does not apply. If agriculturally important farmlands would be converted to non-agricultural uses, the significance of agricultural conversions is assessed using the LESA methodology. The LESA methodology enables the agricultural quality of land to be rated according to a series of agricultural land use criteria, such as acres of important farmland to be converted, and site assessment criteria, such as surrounding land uses, distance to urban land uses, and impacts to agricultural support services.

4.11.4 No Action Alternative

No agriculturally important farmland would be converted under the No Action Alternative, and no impacts to agricultural resources would occur. The Sea would continue to function as a drain for agricultural water under the No Action Alternative.

Effect of No Action Alternative with Continuation of Current Inflow Conditions

Continuation of current inflow would have no effect on agricultural resources. At current levels of inflow the elevation of the sea would remain fairly constant and would not inundate any agriculturally important land. Agricultural economics of the region would not be affected.

Effect of No Action Alternative with Reduced Inflows

Reduced inflow conditions would have no effect on agricultural resources. By the end of Phase 1, if the average inflow to the Sea is reduced to 1.06 maf/yr, the level of the Salton Sea is expected to drop by about 7 feet from its current elevation. The potential for additional salt drift from newly exposed lands to agricultural lands is expected to be negligible since salt on these lands would be washed back into the Sea. Any salt deposits remaining in depressions would be non-friable and not subject to substantial wind movement, similar to current conditions. No agriculturally important farmland on the perimeter of the Sea would be affected by this reduction. Agricultural production in the region would not be affected.

4.11.5 Alternative 1

Construction and operation of the north and south evaporation ponds, and the pupfish pond under Alternative 1, and the associated land disturbance, would have no significant effect on agricultural resources with either current or reduced inflow conditions. Construction and use of the haul road with current inflow conditions would not affect any agriculturally important lands.

Under reduced inflow conditions, approximately 175 acres of agriculturally important farmland in the Imperial Valley could be temporarily taken out of production to accommodate the haul road to the displacement dike. No significant impacts to agriculturally important lands would occur since construction of the haul road would be temporary and would not result in conversion of agricultural land to nonagricultural uses.

Short-term impacts to agricultural productivity may occur as a result of the temporary loss of arable land and indirect effects, such as interference with agricultural practices or lost productivity on adjacent agricultural lands from dust generated by the haul road. While some effect on agriculture may occur, it is not expected that agricultural production in the region would be significantly affected. Standard practices to minimize dust, such as applying water to the roadway, and use of existing rights-of-way or avoidance of agriculturally important lands, when feasible, would further reduce any potential short-term impacts

4.11.6 Alternative 2

Construction of the EES north of Bombay Beach and the associated land disturbance, with either current or reduced inflow conditions, would have no significant effect on agricultural resources. Land that would be developed under this alternative is open desert that is not agriculturally productive. As described under Alternative 1, temporary impacts to agriculturally important farmland and agricultural economics may occur under reduced inflow conditions from construction and use of the haul road, however these impacts would be less than significant. No agriculturally important lands would be affected and agricultural production in the region would not be significantly affected.

4.11.7 Alternative 3

Construction of the EES at the former Salton Sea Test Base would not directly affect any agriculturally important lands. This alternative may, however, indirectly impact to Farmland of Local Importance south of the proposed facility. A citrus orchard occupies approximately 300 acres of land south of the base and between the Sea and Highway 86. The eastern portion of these lands, adjacent to the Sea, is considered Farmland of Local Importance. The remainder of the land occupied by this orchard has not been classified. A barrier of trees is between the base and the orchard, however, prevailing southerly winds could carry salt drift from the EES units to these farmlands. Indirect impacts to Farmland of Local Importance is likely to be less than significant since these lands are slightly removed from the site, a barrier of trees exists between the site and these farmlands, and the EES system would not operate during periods of high winds when the risk of salt drift would be greatest.

In addition, as described under Alternative 1, temporary impacts to agriculturally important farmland and agricultural economics may occur under reduced inflow conditions from construction and use of the haul road, however these impacts would be less than significant. Agricultural production in the region would not be significantly affected.

4.11.8 Alternative 4

Constructing the evaporation ponds and the EES at the former Salton Sea Test Base and the associated land disturbance, with either current or reduced inflow conditions, would have no significant impacts on agricultural resources. As described above for Alternative 3, no agriculturally important lands would be directly affected and indirect effects would be less than significant.

As described under Alternative 1, temporary impacts to agriculturally important farmland and agricultural economics may occur from construction and use of the haul road, however these impacts would be less than significant. Agricultural production in the region would not be significantly affected.

4.11.9 Alternative 5

Collocation of the north evaporation pond and the EES may result in an indirect impact to Farmland of Local Importance south of the proposed facility, as described under Alternative 3. This impact is likely to be less than significant.

As described under Alternative 1, temporary impacts to agriculturally important farmland and agricultural economics may occur from construction and use of the haul road, however these impacts would be less than significant. Agricultural production in the region would not be significantly affected.

4.11.10 Cumulative Effects

Other actions, as discussed in Chapter 2 of this EIS/EIR, could affect agricultural lands and production in the region. While a few of these actions, such as development of wetlands in agricultural areas, may result in minor loss of agricultural land, many of these actions also seek to ensure the agricultural viability in the region. Proposed Phase 1 alternatives would not significantly affect agriculturally important lands or agricultural production in the region and would not contribute to cumulatively significant impacts.

4.11.11 Mitigation Measures

No impacts to agricultural resources would occur, and no mitigation measures would be required.

4.11.12 Potentially Significant Unavoidable Impacts

No potentially significant unavoidable impacts to agricultural resources would occur as a result of any of the alternatives.

4.12 RECREATION RESOURCES

4.12.1 Summary of Environmental Consequences

Recreation is inextricably linked with the quality and physical character of the Sea. The abundance and diversity of aquatic and terrestrial species, the quality of the water, the aesthetic character of the surrounding area, the physical and visual accessibility of the Sea and the quality of the recreation facilities all directly affect the recreational experience. Because of the integral connection between natural resources and recreation values, each alternative has both positive and negative impacts on the existing and potential recreational use of the Sea and surrounding regional recreation.

4.12.2 Significance Criteria

Significance criteria for impacts to recreation uses and/or facilities are defined as:

1. The direct physical degradation of either recreation uses and/or recreation facilities caused by or immediately attributable to the Project. For water related recreation uses, all actions that appear to dramatically reduce the existing extent and quality of the water-related experience are assumed to be significant. Minor reductions to extent and quality which appear to be able to be mitigated are assumed to be moderate impacts.
2. The physical degradation to either recreation uses and/or recreation facilities not immediately related to the project but caused indirectly by the Project.
3. An indirect negative impact to either recreation uses and/or recreation facilities that is "reasonably foreseeable" as a result of actions by the Project.
4. The achievement of short-term improvements for recreation uses and facilities but to the sacrifice of long-term recreation-related interests and goals.
5. A collection of impacts on recreation that individually are limited but cumulatively are considerable.

4.12.3 Assessment Methods

The recreation impact assessment establishes whether the proposed alternatives are compatible with the existing recreation activities and facilities. This analysis examines the impacts proposed alternatives may have on recreational access, facilities and use both on and surrounding the Sea. Impacts are defined as any activity or facility that detracts from the quality of experience or eliminates the use of an existing recreational activity and/or facility.

The methodology utilized to establish potential impacts to recreation began with establishing the existing condition of recreational activities and facilities. This was accomplished by evaluating existing visitor attendance data, interviews with facility operators and on-site evaluations of facilities and their relationship to the Sea. The assessment then combined the proposed alternatives and actions with the existing recreation information to determine is the proposed alternative would impact existing recreation and if so to what level. Critical to this evaluation is the quality of the experience by the public engaged in the specific recreation activity, a recreation opportunity may still exist but the experience may be considerably diminished.

4.12.4 No Action Alternative

Under the No Action Alternative, the quality of the recreational resources would decline. Both the current flow and reduced flow scenarios for this alternative would lead to similar impacts. Without actions to halt the Sea's building salinity levels the recreational resources would continue to be impacted to a point when the in-sea resources present today would no longer exist. Without measures to ensure sea elevation stability, existing and potential future recreation facilities are significantly jeopardized.

Effect of No Action with Continuation of Current Inflow Conditions

The recreation amenities currently associated with the Salton Sea are specifically linked with both the physical configuration of the Sea in terms of the existing shoreline and the aesthetic and biotic qualities supported by the Sea, including the abundance and diversity of biotic systems, its water, and visual quality. Assuming a continuing increase in salinity and water nutrient levels, the long-term consequences of the No Action Alternative on all aspects of recreation uses and facilities within and surrounding the Sea would be severe. The looming stigma of an environment in decline with aquatic and terrestrial species die-off, deteriorating water quality and aesthetic depreciation would overshadow the specific features or resources that attract people to the sea.

This alternative would lead to the eventual decline of the sport fishery due to increasing salinity. The projected shoreline shift would likely impact associated recreation, including camping, boating and other water sports. However, environmental changes could lead to different recreation patterns. The following is a summary of the impacts associated with this alternative on recreation uses and recreation facilities.

- Unstable water elevations would adversely impact all water access facilities. Without certainty of a stabilized elevation, needed improvements for access facilities would likely not occur.
- The sports fishing activities would decline with deteriorating water quality and fish die-off.
- Hunting & bird/wildlife viewing would diminish as the Sea attracts fewer and fewer migratory species.
- Land-based recreation such as camping would experience indirect negative impacts resulting from aesthetic degradation.
- Increasing water salinity could initiate some new recreation options for the Salton Sea. Combined with the thermal springs located east of Bombay Beach, the Sea could possibly attract a growing "health recreation" oriented group similar to the Calistoga Springs facilities in Napa County or the Dead Sea health facilities in Israel.

Effect of No Action with Reduced Inflows (1.06 maf/yr)

If the current inflow is reduced to 1.06 maf, the salinity of the Sea would increase even more under the No Action Alternative. The impacts would be the same as those for the No Action Alternative with current inflow conditions, but to a somewhat greater extent.

4.12.5 Alternative 1

This alternative could result in a short-term increase in Sea elevation. This increase could impact recreational facilities to a greater degree than reduced elevations because of the need to entirely replace the flooded facilities. Modeling for this alternative suggests that with current flow rates, sea levels may increase by up to three feet in the first fifteen years and then tapering and gradually dropping in the following fifteen year period. The lack of certainty related to the quantity and regularity of flood flows leave analysis of impacts related to this alternative is speculative at best. If a constant Sea elevation and reduced salinity levels can be obtained, this alternative would have significant positive impacts on the recreational resources at the Sea.

Effect of Alternative 1 with Current Inflow Conditions

If the evaporation ponds lower salinity levels and stabilize the Sea elevation, the impacts to the recreation resources would be positive in the long term. However, there would be some minor adverse impacts due to construction and reduced access to the Sea. The following is a summary of the impacts associated with Alternative 1.

- Compared with the No Action Baseline conditions, to the extent that these actions are successful in stabilizing Sea water elevations, they would be considered extremely beneficial for boating and water access facilities and the recreation experience in general.
- If these actions are successful in reducing Sea water salinity, resulting impacts would be beneficial for recreation interests especially those uses linked with fishing and wildlife resources.
- There would be new potential recreation benefits associated with this alternative action from an educational interpretive perspective. Environmental restoration measures elsewhere in California have been exploited for recreation/education values and with additional interpretive components, the restoration actions for the Salton Sea could serve that purpose as well.
- The reduced water surface area, approximately 50 square miles, would create a moderate impact to recreational boaters and anglers by removing recreational use area.
- The construction of the dikes would moderately impact wildlife viewing opportunity including both land-side (Naval Test Base lands) and USFWS preserve areas on the Sea.
- Construction period impacts to land-and water-based recreation uses and facilities on the west shore including Salton City and Salton Sea Beach would occur. Significant impacts may include noise, hauling related traffic, and dust disturbances which may detract from the recreation experience.

- Reduced water-based accessibility resulting from the North wetland habitat action is considered a moderate impact in that it would remove a relatively small area of presently accessible water area. However, this area is typically habitat-rich which may be preferred by boating and wildlife enthusiasts.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

If the existing flows are reduced to 1.06 maf, it is anticipated that there would be a greater reduction in the Sea elevation, yielding a significant impact in the existing recreational facilities. The reduced pond size (to 283 square miles) would significantly impact existing recreational facilities and likely require channelization from boating facilities to the lowered shoreline if these facilities were to remain operational. The Displacement Dike that would be implemented with the reduced flow scenario would further reduce the usable Sea surface area, preventing boating access to the U.S.F.W.S. Refuge waterside area and moderately impacting the aesthetic experience in that vicinity.

4.12.6 Alternative 2

This alternative, although located away from the actual shore of the Sea, could have some impacts on recreation. Major impacts would occur from the reduction in shore elevation to approximately 5 feet below existing conditions. Horizontal distance off-set from the present-227 foot elevation would vary depending on the shore gradient and typical off-sets would thus vary from a quarter mile to two miles. This reduction in Sea elevation would be significant to existing recreational facilities use patterns. Another impact could result from aesthetic degradation resulting from significant visual contrast of the evaporation facility with the natural landscape. However, if reduced salinity levels are achieved, this alternative would have significant positive impacts on the receretional resources at the Sea.

Effect of Alternative 2 with Current Inflow Conditions

The following impact assessment assumes that with current flows maintained, the elevation and salinity of the Sea would be reduced. The following is a summary of the impacts associated with Alternative 2.

- Because of the facility's proximity to the most intensely used portion of the Sea shoreline and State Park recreation areas, there are indirect negative impacts to the recreation experience resulting from aesthetic of views to the Sea from Dos Palmas Reserve and the State park facilities. Water intake infrastructure may also impact boating use in its vicinity.
- If actions are successful in stabilizing Sea water elevations, this alternative would be considered extremely beneficial for boating and water access facilities.
- If actions are successful in reducing Sea water salinity, this alternative would be considered beneficial for recreation interests, especially those uses linked with fishing and wildlife resources.
- There would be new potential recreation benefits associated with this alternative action from an educational interpretive perspective. Environmental restoration measures elsewhere in California have been exploited for

recreation/education values and with additional interpretive components, the restoration actions for the Salton Sea could serve that purpose as well.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Similar to the Current Flow scenario, the impacts from the reduced flow scenario combined with Alternative 2 would have the potential to reduce the elevation of the Sea 10 feet below current levels. As with Alternative 1, the displacement dikes associated with this alternative would further reduce the usable Sea area. All other issues addressed in the previous Current Flow Conditions for this alternative also apply to this scenario.

4.12.7 Alternative 3

This alternative differs from Alternative 2 in location and land acquisition only. The following impact assessment assumes that under current flow conditions, Sea elevation could be maintained at or near existing levels with the added inflow of the Flood Flow Common Action. The location of the EES Test Base site is shown on Figure 2.5-8.

Effect of Alternative 3 with Current Inflow Conditions

The following impact assessment assumes that with current flows maintained, the elevation and salinity of the Sea would be reduced. The following is a summary of the impacts associated with Alternative 3.

- This alternative would significantly impact potential land-based recreation uses that would be precluded by the construction of the EES facility at the decommissioned Naval Test Base, including wildlife observation associated uses or the construction of new active recreation facilities.
- Indirect moderate impact to recreation experience would result from aesthetic degradation along State Route 86.
- In comparison with Alternative 2, this alternative is anticipated to have a lesser impact on general recreation use including both water and land-based activities, due to the relative remoteness of the proposed facility site.
- Construction period activities would cause significant impacts to land-based recreation uses and facilities on the west shore including Salton City and Salton Sea Beach.
- If actions are successful in stabilizing Sea water elevations, this alternative would be considered extremely beneficial for boating and water access facilities.
- If actions are successful in reducing Sea salinity levels, this alternative would be considered beneficial for boating and water access facilities, fishing and other land and water associated recreation uses.
- There would be new potential recreation benefits associated with this alternative action from an educational interpretive perspective. Environmental restoration measures elsewhere in California have been exploited for

recreation/education values and with additional interpretive components, the restoration actions for the Salton Sea could serve that purpose as well.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

The impacts of this alternative scenario would be the same as those the impacts identified in the Reduced Flow Conditions for Alternative 2.

4.12.8 Alternative 4

The combination of the concentration ponds and the EES at the Naval Test Base could contribute from moderate to significant impacts to recreation use, depending on the inflow scenario proposed. There could be negative impacts associated with construction activities and reduced access as well as positive impacts associated with increased water quality.

Effect of Alternative 4 with Current Inflow Conditions

Combining concentration ponds with the EES facility would impact the shoreline facilities as mentioned in Alternatives 1 and 3. However, the beneficial impact of greatly reduced salinity levels could assist in bringing new recreational opportunities and facilities to the Sea. If the shoreline can be maintained at or near its present level, the net impact to recreation would be substantially positive. Following are the impacts associated with this scenario.

- The reduced water surface area, approximately 40 square miles, would create a moderate to significant impact to recreational boaters and anglers by removing a substantial recreational use area.
- Similar to Alternatives 1, the construction of the dikes would moderately impact wildlife viewing opportunity including both land-side (Naval Test Base lands) and USFWS preserve areas on the Sea.
- Construction period impacts to land-based recreation uses and facilities on the west shore including Salton City and Salton Sea Beach would be significant for the term of construction. The visual degradation following construction would constitute a moderate impact.
- Possible indirect moderate impact to recreation experience would result from aesthetic degradation especially in the vicinity of the EES facilities along State Route 86 south of Salton City.
- If actions are successful in reducing Sea water elevations, actions would be considered extremely beneficial for long-term boating uses and water access facilities.
- If actions are successful in stabilizing Sea water salinity, actions would be considered beneficial for long-term recreation interests especially those uses linked with fishing and wildlife resources.
- There would be new potential recreation benefits associated with this alternative action from an educational interpretive perspective. Environmental

restoration measures elsewhere in California have been exploited for recreation/education values and with additional interpretive components, the restoration actions for the Salton Sea could serve that purpose as well.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

As with previous alternatives, reduced flows would negatively impact existing shoreline recreation facilities primarily due to its effect of reducing Sea elevations. Additional contrasts resulting from reduced inflow conditions include the accelerated construction of the north wetland habitat and the pupfish pond. As with the other alternatives, the construction of a displacement dike would further reduce the usable Sea area.

4.12.9 Alternative 5

The combination of the EES unit within the proposed evaporation pond offers a concise footprint and a low profile form for the salt removal elements of the restoration effort. From a recreation perspective this alternative would be less obtrusive and consequently result in lesser impacts to the recreation experience.

Effect of Alternative 5 with Current Inflow Conditions

The effects attributable to Alternative 5 are similar to those described in alternatives 1 and 3. Positive attributes of this alternative include demanding less physical area, avoiding the landside evaporation elements, and offering a potentially less obtrusive profile as an element within the concentration ponds. The following is a summary of the impacts associated with Alternative 5.

- Short term impacts to recreation would be associated with construction activities on both waterside and landside areas including the development of evaporation ponds and the EES facility north of the former Salton Sea Test Base near Salton City. These construction related impacts are assumed to be unavoidable; however, because of their short-term nature, they are considered less than significant.
- Recreation impacts associated with operating the evaporation ponds combined with the EES system north of the former Salton Sea Test Base are anticipated to be low to moderate since they would impede physical access to portions of the Sea and would visually impact shoreline and boat use in the vicinity of. Salton City
- If actions are successful in reducing Sea water elevations, actions would be considered extremely beneficial for long-term boating uses and water access facilities.
- If actions are successful in stabilizing Sea water salinity, actions would be considered beneficial for long-term recreation interests especially those uses linked with fishing and wildlife resources.
- There would be new potential recreation benefits associated with this alternative action from an educational interpretive perspective. Environmental restoration measures elsewhere in California have been exploited for

recreation/education values and with additional interpretive components, the restoration actions for the Salton Sea could serve that purpose as well.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

- Compared to the current flow scenario, the effect of reduced inflows in combination with Alternative 5 is estimated to lower the elevation of the Salton Sea approximately 4 feet. The surface area of the sea would be reduced to a greater extent than under current flow conditions. As with the other alternatives, a displacement dike would be required which would further reduce the usable Sea area.

4.12.10 Cumulative Effects

The proposed and current projects underway within the Salton Sea watershed in general would be beneficial to the recreation resources. Projects such as wetland habitat restoration and enhancements, wastewater treatment and water quality improvement projects would enhance recreation by improving water quality. The California 4.4 and Imperial Irrigation District Water Transfer Program could impact recreation significantly due to the reduction of inflow volumes. General water conservation measures resulting in reduced flows into the Sea could, when combined with other reduction programs, create significant impacts to recreation due to reduced inflows.

4.12.11 Mitigation Measures

The following measures are suggested as the minimum actions required to reduce significant impacts associated with the proposed alternatives and actions to less than significant levels as they affect recreation uses and facilities. These suggested mitigation measures do not address those impacts resulting from reduced flow conditions brought on by actions not associated with the proposed alternatives.

- Mitigate visual degradation of EES facilities by implementing extensive vegetative screening with native plant materials.
- For any recreation facilities lost as water elevation rises, replace with in-kind facilities.
- Mitigation for reduction in Sea levels due to project alternatives will include the ability of existing public facilities to operate under varying pond elevation conditions.

4.12.12 Potentially Significant Unavoidable Impacts

Assuming a continuing increase in salinity and water nutrient levels, the long-term consequences of the No Action Alternative on all aspects of recreation uses and facilities within and surrounding the Sea would be severe. To the extent that these trends of declining Sea elevations and diminishing water quality can be abated, the most severe impacts to recreation uses and facilities can be avoided. The majority of actions proposed among the alternatives considered do not cause significant unavoidable impacts to recreation uses or facilities. Even the potential loss of 41 square miles of Sea area does not constitute a significant impact from a recreation use perspective.

4.13 VISUAL RESOURCES AND ODORS

4.13.1 Summary of Environmental Consequences

The proposed EES facilities would result in a significant visual contrast with the existing landscape setting of Salton Sea and its shoreline. Contrasts created by these facilities would attract attention and would be dominant features on the landscape. This impact would most affect views to Salton Sea as seen from SR 86, Salton City, and the former Salton Sea Test Base (for alternatives 3 and 4), and views from SR 111, the Dos Palmas Reserve, and the communities of Lark Spa and Fountain of Youth (for Alternative 2). The views of recreational boaters also would be affected by construction and operation of the EES facility on either side of the Sea. The proposed EES facilities would be inconsistent with the VRM Class II classification for the Salton Sea Basin, and proposed mitigation measures applied to the facility would not reduce this contrast to less than significant levels.

The proposed evaporation ponds under alternatives 1 and 4 similarly would result in a significant contrast with the basin's existing landscape setting. Contrasts would be most evident from viewing locations along the Sea's western shoreline, such as from Salton City, as well as from nearby recreationists, such as boaters.

Proposed project features would be visually dominant from Red Hill Marina on the south shore and be visible from within the Torres Martinez Indian Reservation. Common actions in chapter five, which include fish harvesting, improved recreational facilities, and shoreline cleanup will generally have positive visual impacts for the Salton Sea Basin.

4.13.2 Significance Criteria

Aesthetic resource impacts for the project are analyzed using the VRM Program developed by the BLM, as set forth in the BLM Manual, Sections 8440, H-8410-1, and H-8431-1 (US Department of the Interior, Bureau of Land Management 1978, 1986a, 1986b). The assessment of visual contrast is based on the long-term effects of the project as seen from key visual observation points (KVOP), where sensitivity levels are identified as high or where the project is particularly visible. Several variables are considered in establishing overall visibility levels: view orientation, lighting conditions, view distance, duration of view, viewer numbers, and use associations. Criteria used to rate the level of visual contrast created by the project include changes in the texture, color, line, and form of land and water areas, vegetative patterns and diversity, and existing structures as seen in foreground/middleground views.

Aesthetic impacts are quantified based on the BLM's visual contrast rating system. Out of a maximum possible contrast rating of 30, aesthetic impacts of proposed restoration actions are considered potentially significant if these actions result in a permanent contrast rating of the following:

- Over 20 for VRM Class IV areas;
- Over 16 for VRM Class III areas; or

- Over 12 for VRM Class II areas.

CEQA guidelines consider that a project would have a potentially significant impact if its implementation would result in any of the following:

- Substantially damage scenic resources;
- Substantially degrade the existing visual character or quality of a site and its surroundings; or
- Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

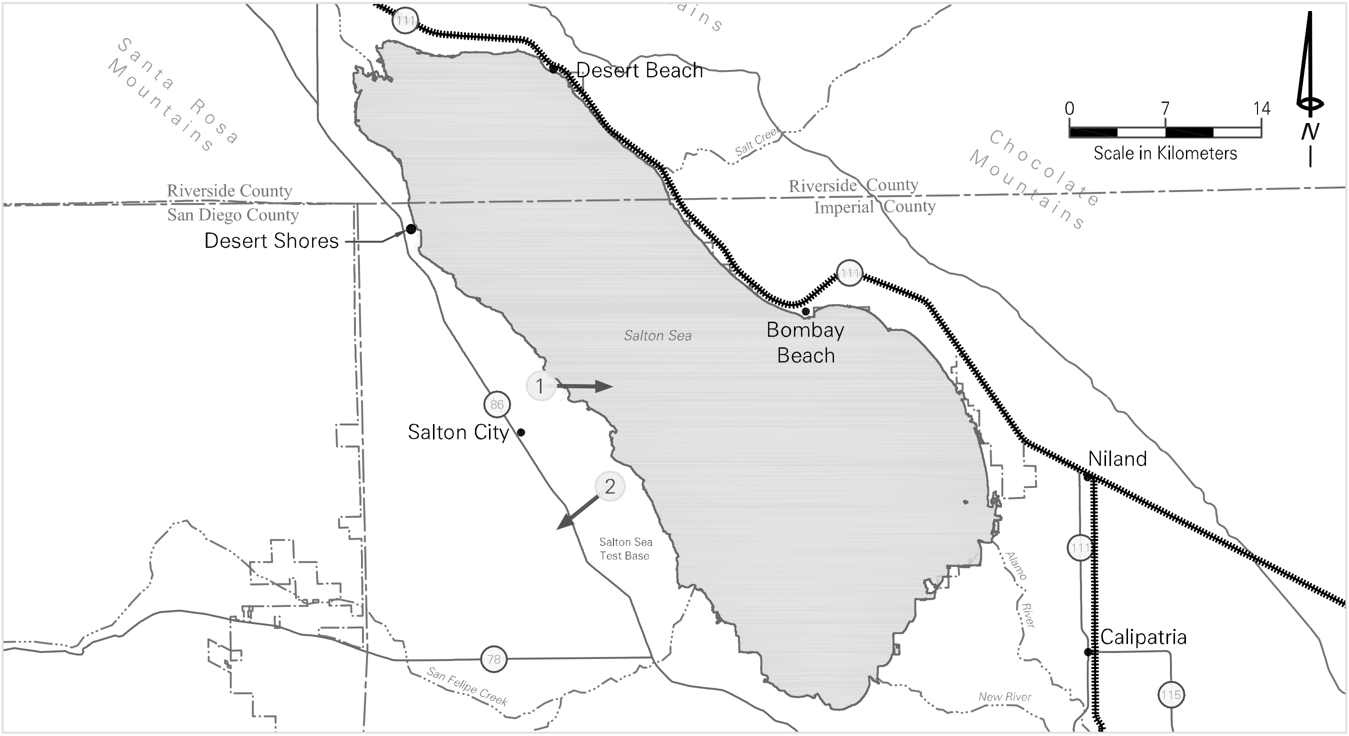
A significant impact also could occur if an alternative resulted in conditions that produced significant odors beyond those experienced under No Action Alternative conditions.

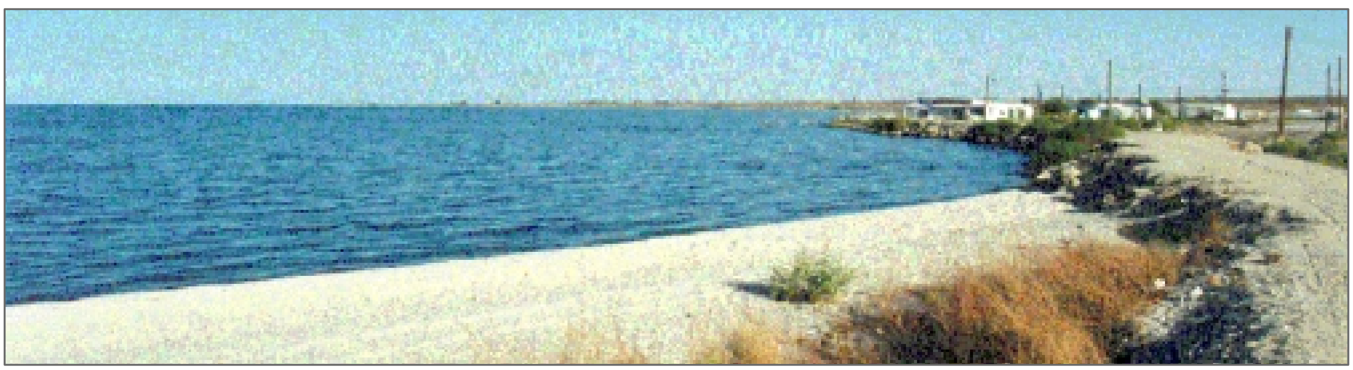
4.13.3 Assessment Methods

The objective of the aesthetic impact assessment is to establish whether new facilities will be compatible with the existing physical landscape setting and to identify landscape features that determine how noticeable such facilities would be. This analysis compares the visual characteristics of the existing landscape with those of proposed facilities and determines the resulting level of contrast. Although not part of the formal BLM contrast rating process, this aesthetic assessment also takes into consideration olfactory aspects of the restoration actions. The adverse aesthetic effect of new or increased odor sources are considered in the overall contrast rating process.

The degree to which the project alternatives affect the visual quality of a landscape depends on the visual contrast created between the project and the existing landscape. Potential aesthetic impacts have been evaluated using a contrast rating system. This assessment process provides a means for determining aesthetic impacts and for identifying measures to mitigate these impacts.

BLM objectives for visual resource management direct that the proposed project be evaluated from key points. Ten KVOPs where viewer sensitivity levels are high to moderate and that view all or part of the proposed restoration areas are used in this analysis. The KVOPs were chosen to be representative of views of the restoration areas from the surrounding region. Factors that were considered in selecting these KVOPs include angle of observation, number of viewers, length of time the project is in view, season of use, and light conditions. The location of each KVOP is shown on figures 4.13-1, 4.13-2, and 4.13-3; these figures include photographs illustrating existing views for seven of the nine KVOPs. Formal contrast ratings for long-term impacts were made from each of these KVOPs (see





1 View southeast from Salton City where northern concentration pond dike would extend and meet shoreline.

2 State Route 86, entrance to Salton Sea Test Base, location of road crossing for haul road. Looking West.

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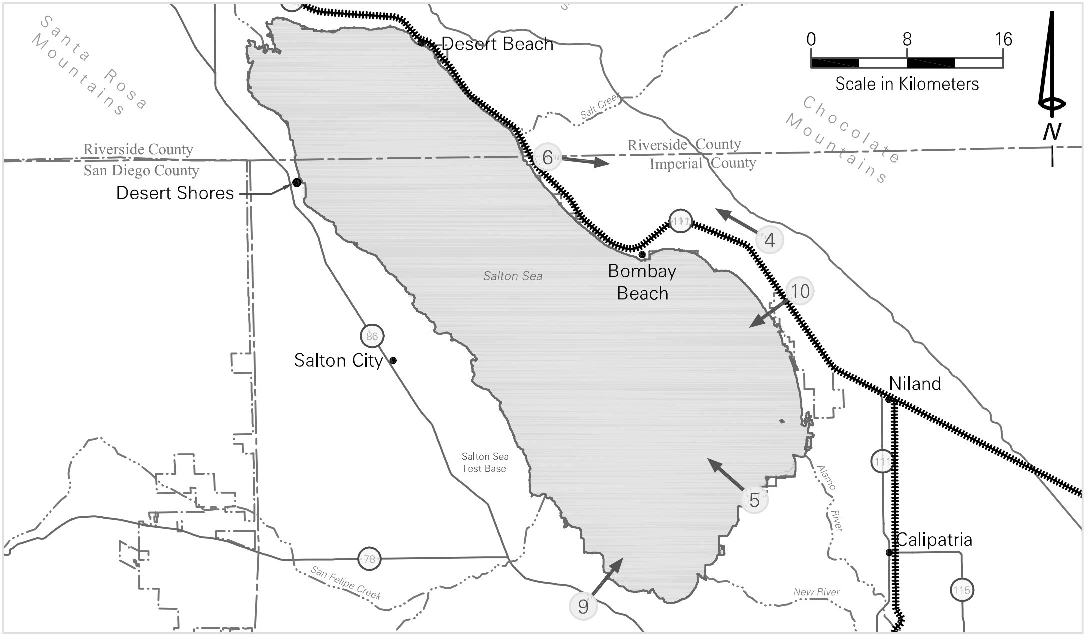
Legend

1 Key Viewer Observation Point and Direction of View

Salton Sea Area

Salton Sea, California

Figure 4.13-1



4 Near Lark Spa and Fountain of Youth communities, looking northwest towards proposed EES facility.

5 Red Hill Marina, looking northwest.

6 State Route 111, traveling south, looking east towards proposed EES project area lands.

9 Photograph unavailable at this time.

10 Photograph unavailable at this time.

Legend

1 Key Viewer Observation Point and Direction of View

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Salton Sea Area

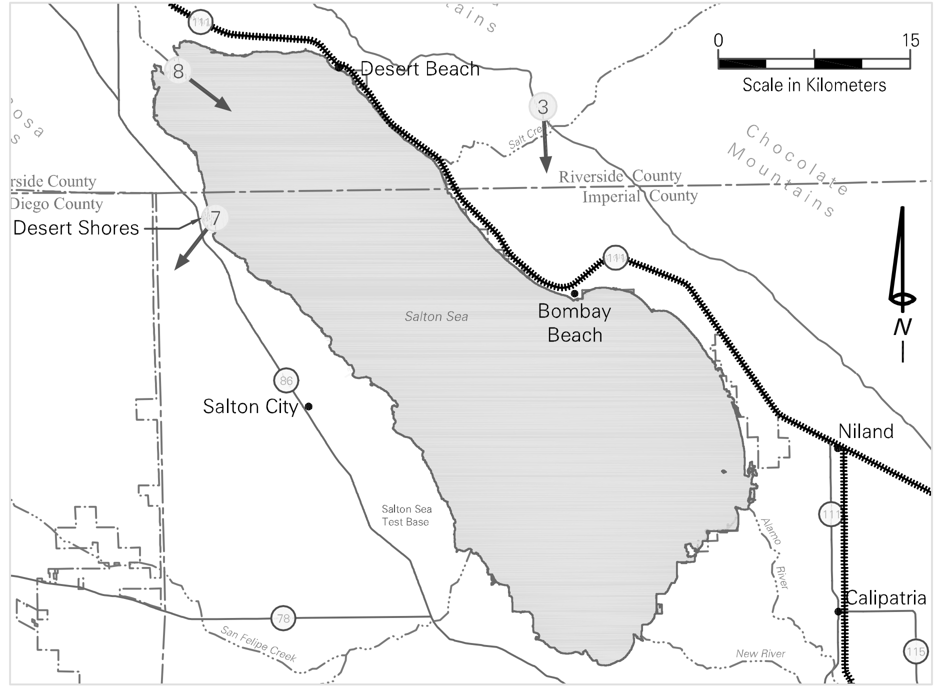
Salton Sea, California

Figure 4.13-2

- Photo Unavailable at this Time -

7 Desert Shores community, looking southwest towards proposed haul road location.

3 The Nature Conservancy, Dos Palmas Reserve, looking south towards proposed EES site.



8 Torres Martinez Reservation, looking southeast from shoreline.

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Legend

1 Key Viewer Observation Point and Direction of View

Salton Sea Area

Salton Sea, California

Figure 4.13-3

Appendix D). Table 4.13-1 summarizes the results of the contrast analysis relative to the significance criteria.

(**Note to Reviewers**: *The visual contrast analysis is based on interim, unofficial VRM classifications that are highly conservative and are assumed as part of the impact analysis. Tetra Tech is awaiting receipt of official BLM VRM classifications for the Salton Sea Basin from the El Centro BLM Office. Therefore, the conclusions presented in the impact analysis are preliminary and subject to change.*)

Table 4.13-1
VRM Significance Levels and Contrast Ratings

KVOP	Existing VRM Classification[1]	Contrast Rating/ Significance Threshold	Contrast Rating from KVOP[2]	Distance Zone
Salton City	Class II	12	17	Foreground/middleground (concentration ponds, EES and former Salton Sea Test Facility)
SR 86- (near Salton Sea Test Base)	Class II	12	27	Foreground/middleground (concentration ponds and EES at former Salton Sea Test Base)
SR 86- (segment from Salton Sea Test Base to southern tip of Salton Sea)	Class II	12	7	Foreground/middleground (pupfish pond)
Dos Palmas Reserve	Class II	12	20	Foreground/middleground (EES at Bombay Beach)
Lark Spa and Fountain of Youth Communities	Class II	12	19	Foreground/middleground (EES at Bombay Beach)
Red Hill Marina	Class II	12	10	Seldom seen (EES at Bombay Beach); background (EES at former Salton Sea Test Facility/ concentration ponds)
SR 111	Class II	12	28	Foreground/middleground (EES at Bombay Beach)
SR 111 (segment closest to and between Bombay Beach and Mullet Island)	Class II	12	7	Foreground/middleground (southeast shorebird pond)
Desert Shores	Class II	12	9	Foreground/middleground (Haul Road)
Torres Martinez Indian Reservation	Class II	12	9	Background/seldom seen (EES and concentration pond facilities)

[1] VRM classifications are interim unofficial designations and are highly conservative, assumed as part of the impact analysis. Tetra Tech is awaiting the receipt of official BLM VRM classifications for the Salton Sea Basin. Therefore, the conclusions presented in the impact analysis are preliminary and are subject to change.

[2] See Appendix D.

The ten KVOPs are as follows:

- Salton City, looking east toward Salton Sea;
- SR 86, traveling both north and south, looking east;
- SR 86, traveling both north and south, segment from Salton Sea Test Base to southern tip of Salton Sea, looking northeast;
- Dos Palmas Reserve, looking south;
- The communities of Lark Spa and Fountain of Youth, looking northwest;
- Red Hill Marina, looking north and northwest;
- SR 111, traveling both north and south, looking east;
- SR 111, traveling both north and south; segment 5 miles south of Bombay Beach to Mullet Island; looking west;
- Desert Shores, looking west (toward proposed haul road); and
- Torres Martinez Indian Reservation, looking south/southeast.

Observer positions and routes of travel where viewer sensitivity levels are high to moderate and with potential views to the proposed evaporation ponds (alternatives 1 and 4) and EES facility at the Salton Sea Test Base (alternatives 3,4) include residences in Salton City and motorists traveling both north and south along SR 86.

Observer positions and routes of travel where viewer sensitivity levels are high to moderate and with potential views to the proposed EES facility near Bombay Beach (Alternative 2) include the following:

- Dos Palmas Reserve;
- The communities of Lark Spa and Fountain of Youth; and
- SR 111 traveling both north and south.

Observer positions and routes of travel where viewer sensitivity levels are high to moderate and with potential views to the proposed haul road adjacent and parallel to SR 86 (alternatives 1 and 4) include residences at Salton City and Desert Shores and motorists on SR 86, traveling both north and south.

The contrast ratings for each project element at the KVOPs have been compared with the objectives for the VRM class. For comparison, the four levels of contrast (none, weak, moderate, and strong) roughly correspond with classes I, II, III, and IV, respectively. This means that a strong contrast rating may be acceptable in a Class IV area but probably would not meet the VRM objectives for a Class III area. If the contrast rating scores meet the requirement for the VRM class, the visual impact is considered insignificant. If the contrast exceeds the requirement for the VRM class, the impact is considered significant. For significant impacts, the contrast rating score is used to identify what features and elements can be lowered to meet the assigned VRM contrast rating standards. Since the overall VRM goal is to minimize visual impacts, mitigation measures are proposed for all adverse contrasts that can be reduced.

4.13.4 No Action Alternative

Effect of No Action Alternative with Continuation of Current Inflow Conditions

No significant visual impacts would occur under the No Action Alternative with a continuation of the current inflow conditions because the level of the Salton Sea would be expected to remain relatively constant. The degree of visual contrast would be rated as "none" because any change in Sea elevation would not be visible or perceived. Similarly, expected increases in salinity levels would have no noticeable visual effects.

The No Action Alternative with current inflows may result in an increase in noxious odors if current flows cause an increase in conditions that produce odors, such as algal blooms and fish and avian die-offs.

Effect of No Action Alternative with Reduced Inflows

Significant visual impacts would be expected under the No Action Alternative with reduced inflows. Implementing this alternative would have a moderate to strong visual contrast with the surrounding landscape because the level of the Salton Sea is expected to drop by approximately 15 feet from its current elevation. Under this scenario, approximately 35 square miles of natural water features along the shoreline would be replaced with exposed seabed. Views of the Salton Sea currently visible to residents, pedestrians, drivers, and recreationists would be altered throughout the basin; specific effects would depend on the location and nature of viewer.

The No Action Alternative with reduced inflows may result in an increase in noxious odors if reduced flows cause conditions that produce an increase in odors, such as algal blooms and fish and avian die-offs.

4.13.5 Alternative 1

Effect of Alternative 1 with Continuation of Current Inflow Conditions

Compared to the no action existing conditions (current (average) inflow, the effect of inflows associated with Alternative 1 would be to lower the elevation of the Salton Sea approximately five feet.

<u>*Construction Activities*</u>

North and South Evaporation ponds (98kaf/year). Constructing the evaporation ponds and haul road would occur over an approximate 48-month period. During this period, construction activities would be noticeably visible in the foreground/middleground view of residents in Salton City and Desert Shores, as well as for motorists traveling north and south along SR 86. Residents and motorists would observe a high visual contrast to the existing setting caused by activities that include the following:

- Large pieces of equipment used for dredging sludge material, placing fill material, and trucking borrow material and assorted construction vehicles;
- Construction signs and lights and a temporary haul road; and
- Construction materials, site office trailers, portable toilets, fencing, and parking areas.

Fugitive dust from construction areas, including potential emissions from trucks hauling borrow material, could be noticeable immediately adjacent to construction areas and along the temporary haul route. Visual impacts due to construction are unavoidable. However, because of their temporary short-term nature, they are considered less than significant.

Pupfish pond. The pupfish pond would be constructed over an approximate 36-month period. Construction activities would be slightly visible in the foreground and middleground view of motorists traveling north and south along SR 86, specifically along the segment between the Salton Sea Test Base and the southern tip of Salton Sea. Other visual impacts due to construction would be similar to those discussed for the north and south evaporation ponds.

Facility Operations

North and South Evaporation ponds (98kaf/year). The evaporation ponds would generally occur in the middleground to background views of the surrounding Salton Sea Basin. For example, at a distance of approximately five miles, the visual contrast of the ponds from views in the vicinity of the Red Hill Marina on the south shore would be weak. The water level of the ponds would blend in with the surrounding flat topography and distant horizon line across the Sea. The only vertical element that would be moderately visible would be the constructed dikes, 35 feet high. Viewers most likely affected by the features would be Salton City residents near the shoreline and recreational boaters.

Salton City: As seen from the shoreline at Salton City, the prominent mass and stark color and texture created by the engineered dikes would contrast noticeably with the natural form, color, and texture of the open Sea landscape. This visual contrast would reduce the Sea's visual intactness and unity and could block scenic shoreline views of the distant Chocolate Mountains. The contrast rating threshold of significance for this area is 12, and the proposed facilities implemented under Alternative 1 would have a contrast rating of 17 for KVOP #1. Therefore, the project would exceed the threshold of significance and would be considered a significant visual impact.

Pupfish pond. The pupfish pond would generally occur in the foreground and middleground views of the Salton Sea Basin Basin. The only vertical element that would be slightly visible would be the constructed dikes to accommodate this protection pond, three feet in height and one foot in depth. On the shorebird pond side, the water elevation of the pond would be level with the height of the dike and would blend in with the surrounding flat topography and distant horizon line across the Sea. Because water level on the sea side (concentration ponds) would drop three feet, the top of the constructed dikes (one foot in depth and wall similar to a "z" shape) would be slightly visible from a distance. The dike would be located from the north and southern ends of the southwest evaporation pond extending to the shoreline, creating a protection pond between the shore and evaporation pond. Viewers most likely affected by this element would be motorists traveling along SR 68, specifically the roadway segment defined by the Salton Sea Test Base and the southern tip of Salton Sea.

The contrast rating threshold of significance for this area is 12, and the pupfish pond would have a contrast rating of 7 for KVPO #9. Therefore, the project would not exceed the threshold of significance and would not be considered a visual impact.

Odors

Under Alternative 1, constructing the concentration ponds could generate temporary odors while sludge material is being dredged from the dike foundation areas. More permanent odors could result if the ponds were to generate algal blooms. However, potential impacts associated with this new odor source would be at least partially offset if a reduction in salinity improved the condition of the Sea, resulting in fewer algal blooms and fish and avian die-offs in this larger water body.

Operation of a fish processing plant at the Torres Martinez Indian Reservation or the Salton Sea Test Base could result in significant odor problems. Fish byproduct manufacturing uses fish waste or fish not suitable for human consumption to produce fish meal, fish oil, or other product. During the boiling, drying, and evaporation of press water used in the manufacturing process, vapors are generated. Proteins, crude fats, and volatile organic acids dissolved in the vapors can spread highly unpleasant odors to the surrounding areas; the degree to which odors spread are determined by the volume of the vapor and local meteorological conditions. These odors could have a significant impact on surrounding sensitive residential and recreational areas if not controlled. Control measures for fish byproduct processing include the use of afterburners, chlorinator-scrubbers, or condensers. Use of such control technology can provide up to nearly 100 percent odor control (US EPA 1995).

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 MAFY)

Compared to current inflow conditions (1.363 MAFY), the effect of reduced inflows (1.06 MAFY) associated with Alternative 1 would be to lower the elevation of the Salton Sea approximately eight feet. However, compared to the No Action Alternative with reduced inflow conditions, the effect of Alternative 1 with reduced inflows would be to reduce the elevation of the Salton Sea by approximately three feet. Views of the proposed evaporation ponds from Salton City would be similar to those described above for conditions that assume continuation of current inflow conditions. However, compared to existing conditions, Alternative 1 with reduced inflows may result in both additional visual contrast along the shoreline and an increase in noxious odors if reduced flows in the Sea cause conditions that produce an increase in odors, such as algal blooms and fish and avian die-offs. Alternative 1 with reduced inflows also could produce odors at the concentration ponds. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed above.

Construction Activities

Displacement Dike. Constructing the displacement dike would occur over an approximate 48-month period. During this period, construction activities would be noticeably visible in the foreground/middleground view of recreationalists in Red Hill Marina and of recreational boaters and in the middleground/background for motorists traveling north and south along SR 111. Recreationalists and motorists would observe a high visual contrast to the existing setting caused by construction activities similar to those discussed for the north and south evaporation ponds. Visual impacts due to construction are unavoidable. However, because of their temporary short-term nature, they are considered less than significant.

North wetland habitat. The north shorebird and pupfish protection pond would be constructed over an approximate 36- month period. Construction activities would be noticeably visible in the foreground and middleground view of residents in the Torres Martinex Reservation. Construction activities would be moderately visible in the middleground/background view of residents in Desert Shores and Desert Beach. Other visual impacts due to construction would be similar to those discussed for the north and south evaporation ponds.

Facility Operations

Displacement Dike. The displacement dike would generally occur in the foreground to middle ground views of the surrounding Salton Sea Basin. The visual contrast of the dike from views of Red Hill Marina would be strong. Since it is expected that the area the dikes will displace will be dry for most of the year, the dike (35 feet in height) would be completely exposed and considered a significant vertical element visible from the Red Hill Marina shorelines. Dependent on the current water elevation, the top of the dike, 30 feet in depth, would be visible to recreational boaters.

Red Hill Marina: As seen from the shoreline at Red Hill Marina, the prominent mass and stark color and texture created by the engineered dikes would contrast noticeably with the natural form, color, and texture of the open Sea landscape. This visual contrast would reduce the Sea's visual intactness and unity of the landscape. The wall of the dike, 35' in height, would be entirely exposed, visible from Red Hill Marina. The dike would be approximately 16 miles in length and would extend from two designated points along the shoreline into the sea (see Figure 2.4-4). The contrast rating threshold of significance for this area is 12 and the proposed facilities implemented under the Alternative 1 would have a contrast rating of 29 for KVOP #5. Therefore the project would exceed the threshold of significance and would be considered a significant visual impact.

North wetland habitat. The north shorebird and pupfish protection pond would generally occur in the foreground and middleground views of the Salton Sea Basin Basin. Visual impacts due to facility operations would be similar to those discussed for the pupfish pond. Viewers affected by this element would be the residents of the Torres Martinex Reservation.

The contrast rating threshold of significance for this area is 12 and the proposed facilities implemented under the Alternative 1 would have a contrast rating of 7 for KVOP #7. Therefore the project would exceed the threshold of significance and would be considered a significant visual impact.

4.13.6 Alternative 2

Effect of Alternative 2 with Continuation of Current Inflow Conditions

Construction Activities

EES located North of Bombay Beach. Constructing the EES facility would occur over an approximate 36-month period. During this period, construction activities would be noticeably visible in the foreground/middleground view of residents in the communities of Lark Spa and Fountain of Youth, as well as to motorists traveling north and south along SR 111, a state-designated scenic highway. Other viewers that could be temporarily affected during construction include recreationists along the eastern seashore and at the nearby Dos Palmas Reserve, north of the proposed facility.

Residents, motorists, and recreationists would observe a high visual contrast to the existing setting caused by activities that include the following:

- Construction materials, site office trailers, portable toilets, fencing, and parking areas;
- Construction signs and lights; and
- Large pieces of equipment used to create the underground tunnel accommodating the intake structure for the EES system

Constructing the EES facility near Bombay Beach would be noticeably visible in the foreground/middleground view of residents in the communities of Lark Spa and Fountain of Youth, as well as to motorists traveling north and south along SR 111, a state-designated scenic highway. Other viewers that will be temporarily affected during construction include recreationists along the eastern seashore and at the nearby Dos Palmas Reserve, north of the proposed facility. Residents, motorists, and recreationists would observe a high visual contrast to the existing setting caused by construction activities that include use and storage of large pieces of equipment and building materials.

As described above for Alternative 1, fugitive dust from construction areas, including potential emissions from trucks, could be noticeable immediately adjacent to construction areas. Visual impacts due to construction are unavoidable. However, because of their short-term nature, they are considered less than significant.

Facility Operations

EES located North of Bombay Beach. Developing the EES system near Bombay Beach would have a moderate to strong visual contrast within the surrounding area. The most dominant visual elements would be the series of approximately 85- to 150-foot towers. These towers are expected to be lighted at night to warn aircraft of their presence. The site would attract viewer attention and may begin to dominate the landscape when viewed from close points along SR 111, a state-designated scenic highway that supports local, commercial, and tourist travel. Other nearby sensitive visual receptors that would be moderately affected by this alternative are residents in the nearby communities of Lark Spa and Fountain of Youth, approximately 3.5 miles to the southeast, as well as visitors to the Dos Palmas Reserve to the north.

Due to intervening topography that skirts segments of the Salton Sea shoreline, the EES system would not be visible from portions of SR 111 or from Bombay Beach. In addition, these facilities would be in the "seldom seen" zone, beyond 15 miles from more distant observation points, such as the Torres Martinez Indian Reservation and the Red Hill Marina, and western shore communities, such as Salton City and Desert Shores.

Dos Palmas Reserve: The proposed EES facilities would be seen as an element in the foreground/middleground from the Dos Palmas Reserve, approximately 3.5 miles north of the project site. From this vantage, there is no mountain backdrop. Although this view is cluttered with transmission line poles and wires in the distant foreground, the proposed engineered features of the new EES facilities would create a silhouette that would contrast moderately with the barren desert landscape and open expansive background.

The contrast rating threshold of significance for this area is 12 and the contrast rating for the Dos Palmas Reserve (KVOP #3) would be 20. Therefore, the visual impacts from this location would be considered significant.

Communities of Lark Spa and Fountain of Youth: The proposed EES facilities would be seen as an element in the foreground/middleground from Lark Spa and Fountain of Youth, approximately 3.5 miles southeast of the project site. Though the proposed facilities would be visible, they would occupy only a portion of the panoramic view over the basin from this perspective and would not completely block views of the scenic mountain backdrop west of the Sea. Nevertheless, the introduction of large engineered features into this natural desert landscape would create a moderate contrast compared to the existing visual environment.

The contrast rating threshold of significance for this area is 12 and the contrast rating for Lark Spa and Fountain of Youth (KVOP #4) would be 19. Therefore, the visual impacts from this location would be considered significant.

_SR 111_: As seen from nearby foreground viewpoints along SR 111, the strong lines and patterns of the engineered features, such as the tower modules and precipitation ponds, would contrast noticeably with the natural horizontal plane of the flat desert landscape and the vivid mountainous backdrop. Similarly, the gray concrete ponds and towers would contrast moderately with the blue-gray backdrop of the Orocopia and Chocolate mountains. Although these features would be visible only from portions of the eastern seashore and surrounding environs, they would render this facility a local visual landmark. The impact would be most vivid when in the foreground/middleground viewing distance.

The degree to which the water sprayed from the towers would be viewed as a distinct visible feature and would vary with atmospheric conditions (e.g., the system would be shut down when winds exceeded 14 miles per hour). The water would be sprayed from the towers before precipitating into the ponds below and would be visually similar to fog and therefore would produce only a weak to moderate visual contrast against the mountain backdrop.

The contrast rating threshold of significance for this area is 12, and the contrast rating for the KVOP at this location (KVOP #6) would be 28. Therefore, the visual impacts from SR 111 would be considered significant.

Odors

Under Alternative 2, beneficial odor impacts would occur if a reduction in salinity improved the condition of the Sea, resulting in fewer algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Effect of Alternative 2 with Reduced Inflow Conditions

Compared to existing conditions, the effect of reduced inflows associated with Alternative 2 would be to lower the elevation of the Salton Sea approximately 18 feet. However, compared to the No Action Alternative with reduced inflow conditions, the effect of Alternative 2 with reduced inflows would be to lower the elevation of the Salton Sea by only approximately three feet.

Under both scenarios, views of the proposed EES facility near Bombay Beach from SR 111 and other nearby sensitive viewing locations would not be substantially different from those described above for conditions that assume continuation of current inflow conditions because the Sea is not visible in these views. However, additional visual contrast would result for boaters under these scenarios because natural water features along the shoreline would be replaced with exposed seabed. Compared to existing conditions, there would be an increase of approximately 91 square miles of exposed seabed, as opposed to only 21 square miles of additional seabed compared to the No Action Alternative with reduced inflows. Views for motorists along State Route 111 looking west across the Sea could similarly be negatively affected. Furthermore, Alternative 2 with reduced inflows may result in an increase in noxious odors if reduced flows cause conditions that produce an increase in odors, such as algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed above.

Displacement Dike. Impacts related to both construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

North wetland habitat. Impacts related to construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

Construction Activities

Import Flood Flows. Improvements would be made to the Alamo Channel and minor maintenance of evacuation areas along the Coachella Branch to Salton Sea. Improvement activities would not be noticeably visible in the foreground, middleground, or background around these areas. Construction activities would be similar to those discussed in Alternative 2.

Facility Operations

The importing of flood flows would not have a visual impact to the landscape.

4.13.7 Alternative 3

Effect of Alternative 3 with Continuation of Current Inflow Conditions

Construction Activities

EES located at the Salton Sea Test Base. Constructing the EES facility at the former Salton Sea Test Base would occur over an approximate 36-month period. During this period, construction activities would be noticeably visible in the foreground/middleground views of motorists traveling both north and south along SR 86, as well as in views from nearby recreationists along the western shoreline and in the Sea. Motorists and recreationists would observe a high visual contrast to the existing setting, caused by construction activities that include use and storage of large pieces of equipment and building materials.

As described above for Alternative 1, fugitive dust from construction areas, including potential emissions from trucks, could be noticeable immediately adjacent to construction areas. Visual impacts due to construction are unavoidable. However, because of their temporary, short-term nature, they are considered less than significant.

Facility Operations

Developing the EES system on the former Salton Sea Test Base site would have a strong visual contrast with the surrounding landscape. The approximate 85- to 150-foot towers would be located directly to the east and west of SR 86. Proposed facilities also would be visible to pedestrians using the shoreline at Salton City and to recreational boaters. EES facilities would be in the "seldom seen" zone, beyond 15 miles from more distant observation points, such as the Torres Martinez Indian Reservation, the Red Hill Marina, and eastern shore communities such as Bombay Beach and Desert Beach.

<u>SR 86</u>: As seen from nearby foreground viewpoints along SR 86, the strong lines and patterns of the engineered features, such as towers and ponds, would contrast noticeably with the natural horizontal plane of the flat desert landscape and the mountain backdrops to the east and west. Similarly, the gray concrete ponds and towers would moderately contrast with the blue-gray backdrop of the distant mountains. Although these features would be distinctly visible only from portions of SR 86, they would render this facility a local visual landmark. The impact would be most vivid when in the foreground/middleground viewing distance.

As described under Alternative 2, the degree to which the water sprayed from the towers would be viewed as a distinct visible feature would vary with atmospheric conditions (e.g., the system would be shut down when winds exceeded 14 miles per hour). The water would be sprayed from the towers before precipitating into the ponds below and would produce only a weak to moderate visual contrast against the distant mountain backdrops.

The contrast rating threshold of significance for this area is 12, and the contrast rating for the KVOP at this location (KVOP #2) would be 27. Therefore, the visual impacts from SR 86 would be considered significant.

<u>Odors</u>

Under Alternative 3, beneficial odor impacts would occur if a reduction in salinity improved the condition of the Sea, resulting in fewer algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Effect of Alternative 3 with Reduced Inflow Conditions

Compared to existing conditions, the effect of reduced inflows associated with Alternative 3 would be to lower the elevation of the Salton Sea approximately 18 feet. However, compared to the No Action Alternative with reduced inflow conditions, the effect of Alternative 3 with reduced inflows would be to lower the elevation of the Salton Sea by only approximately three feet.

Views of the proposed EES facility at the former Salton Sea Test Base from SR 86 would not be substantially different from those described above for conditions that assume continuation of current inflow conditions because the Sea is approximately six miles to the east and not highly visible. However, additional visual contrast would result for boaters under these scenarios because natural water features along the shoreline would be replaced with exposed seabed. Compared to existing conditions, there would be an increase of approximately 91 square miles of exposed seabed compared to only 21 square miles of additional seabed under a No Action Alternative with reduced inflows. Furthermore, Alternative 3 with reduced inflows may result in an increase in noxious odors if reduced flows cause an increase in conditions that produce odors, such as algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Displacement Dike. Impacts related to construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

North wetland habitat. Impacts related to construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

Import Flood Flows. Impacts related to construction and facility operations would be similar to those discussed under Alternative 2 reduced inflow conditions.

4.13.8 Alternative 4

Effect of Alternative 4 with Continuation of Current Inflow Conditions

Construction Activities

South Evaporation Pond and EES system located at Salton Sea Test Base. Visual impacts would be associated with constructing the evaporation ponds combined with the effects of constructing the EES at the former Salton Sea Test Base. These effects are discussed under alternatives 1 and 3, respectively. Visual impacts due to construction would be unavoidable; however, because of their short-term nature, they are considered less than significant.

Pupfish pond. Visual impacts are similar to those discussed in Alternative 1 reduced flows.

Facility Operations

South Evaporation Pond and EES system located at Salton Sea Test Base. Visual impacts associated with operating the evaporation ponds combined with the EES system on the former Salton Sea Test Base would be significant because both facilities would create a strong visual contrast with the surrounding landscape. The 85- to 150-foot towers would be directly east of SR 86, and pedestrians using the shoreline at Salton City or recreational boaters also would see these structures. These effects are discussed under alternatives 1 and 3, respectively.

Pupfish pond. Visual impacts are similar to those discussed in Alternative 1 reduced flows.

Odors

Under Alternative 4 constructing the concentration ponds could generate temporary odors while sludge material is dredged from the dike foundation areas. Odors that are more permanent could result if the ponds generate algal blooms. However, these odors could be offset if a reduction in salinity improved the condition of the Sea, resulting in fewer algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Effect of Alternative 4 with Reduced Inflow Conditions

Compared to existing condition, the effect of reduced inflows associated with Alternative 3 would be to lower the elevation of the Salton Sea approximately 13 feet. However, compared to the No Action Alternative with reduced inflow conditions, the effect of Alternative 3 with reduced inflows would be to raise the elevation of the Salton Sea by approximately two feet.

Views of the proposed evaporation ponds and EES facilities from SR 86 would be similar to those described above for conditions that assume continuation of current inflow conditions. However, compared to existing conditions, additional visual contrast would result because approximately 48 square miles of natural water features along the shoreline would be replaced with exposed seabed. Alternative 4 with reduced inflows also may result in an increase in noxious odors if reduced flows cause an increase in conditions that produce odors, such as algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Displacement Dike. Impacts related to construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

North wetland habitat. Impacts related to construction and facility operations would be similar to those discussed under Alternative 1 reduced inflow conditions.

Import Flood Flows. Impacts related to construction and facility operations would be similar to those discussed under Alternative 2 reduced inflow conditions.

4.13.9 Alternative 5

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Construction Activities

EES Within Evaporation Pond. Visual impacts would be associated with constructing the evaporation ponds combined with the effects of constructing the EES north of the former Salton Sea Test Base opposite Salton City. These effects are discussed under alternatives 1 and 3, respectively. Visual impacts due to construction would be unavoidable; however, because of their short-term nature, they are considered less than significant.

North wetland habitat. Impacts are similar to those discussed under Alternative 1 reduced flow conditions.

Facility Operations

EES Within Evaporation Pond. Visual impacts associated with operating the evaporation ponds combined with the EES system north of the former Salton Sea Test Base would be significant because both facilities would create a strong visual contrast with the surrounding landscape. The 85- to 150-foot towers would be directly east of SR 86, and pedestrians using the shoreline at Salton City or recreational boaters also would see these structures. These effects are discussed under alternatives 1 and 3, respectively.

North wetland habitat. Impacts are similar to those discussed under Alternative 1 reduced flow conditions.

Odors

Under Alternative 5 constructing the concentration ponds could generate temporary odors while sludge material is dredged from the dike foundation areas. Odors that are more permanent could result if the ponds generate algal blooms. However, these odors could be offset if a reduction in salinity improved the condition of the Sea, resulting in fewer algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Effect of Alternative 5 with Reduced Inflow Conditions

Compared to existing condition, the effect of reduced inflows associated with Alternative 3 would be to lower the elevation of the Salton Sea approximately 13 feet. However, compared to the No Action Alternative with reduced inflow conditions, the effect of Alternative 3 with reduced inflows would be to raise the elevation of the Salton Sea by approximately two feet.

Views of the proposed evaporation ponds and EES facilities from SR 86 would be similar to those described above for conditions that assume continuation of current inflow conditions. However, compared to existing conditions, additional visual contrast would result because approximately 48 square miles of natural water features along the shoreline would be replaced with exposed seabed. Alternative 4 with reduced inflows also may result in an increase in noxious odors if reduced flows cause an increase in conditions that produce odors, such as algal blooms and fish and avian die-offs. Impacts and potential mitigation measures for a fish processing plant would be the same as discussed under Alternative 1.

Displacement Dike. Impacts associated with both construction and facility operation are similar to those discussed under Alternative 1 reduced inflow.

Import Flood Flows. Impacts associated with both construction and facility operation are similar to those discussed under Alternative 1 reduced inflow.

4.13.10 Cumulative Effects

As discussed in Chapter 2, a number of regional projects could have long-term effects on the average annual inflows to the Sea. The most likely result of these cumulative projects is that future inflows to the Sea could be lower than current conditions. The effects of such an inflow reduction on visual resources have been discussed for each alternative.

Other projects could contribute to significant cumulative visual effects from a regional perspective when combined with restoration of the Salton Sea. For example, there are several proposals to construct major new facilities, such as a wastewater treatment plant in Mexicali, a regional landfill in eastern Imperial County, and a new industrial and commercial complex near the Calexico and the US/Mexico border. Other planned developments involve expanding existing facilities, such as the Mesquite Gold Mine in eastern Imperial County. However, these projects would not be visible from the viewsheds associated with the Salton Sea restoration project and therefore would not contribute to any localized cumulative impacts.

Indirect cumulative effects could occur if reduced inflows caused conditions that produce noxious odors to increase over baseline conditions.

4.13.11 Mitigation Measures

Mitigation Measures for Construction Activities (Alternatives 1 through 4)

Although visual impacts associated with construction activities are considered less than significant, the following mitigation measures are recommended to further reduce construction-related visual effects:

- Follow standard construction methods to minimize the visual impact caused by construction disruption. These include limiting construction access to identified travel routes, designating layout space and other construction zones to predefined areas, and implementing dust control measures.
- When construction is completed, evaluate any disturbance at temporary laydown and equipment storage areas and restore these areas to their pre-construction condition.
- Remove construction equipment from the project area when it is no longer needed.

Mitigation Measures for Operation of Evaporation Ponds (Alternatives 1 and 4)

The following mitigation measures are recommended to reduce the visual contrast between the color, form, and texture of the proposed evaporation ponds and that of the existing landscape character:

- To maintain the visual integrity and unity of the Salton Sea shoreline as seen from SR 86, paint the proposed dikes a color that blends with the immediate natural desert landscape. The selected color should be a shade darker than the pale beige tones of the adjacent landscape to compensate for effects of shade and shadow.
- To reduce color contrast, use only nonreflective materials throughout the evaporation pond facility.

- To minimize contrast with the horizontal character of the Salton Sea shoreline, design the facility to emphasize horizontal lines.

Although the recommended mitigation measures would reduce the visual contrasts of the evaporation ponds and related facilities, proposed project impacts from Salton City would still be considered significant.

Mitigation Measures for Operation of EES Facility (Alternatives 2, 3, and 4)

To reduce the visual contrast between the color, form, and texture of the proposed EES facilities, including the tower modules and precipitation ponds, and that of the existing landscape character, implement the measures identified for operation of the evaporation ponds, along with the following measures:

- To reduce color contrast, use nonreflective fencing throughout the project site, and, where feasible, install native landscaping to screen facilities and create a more natural-looking environment; and
- Construct a pull out off a nearby highway (e.g., SR 111 or SR 86) that includes a small sign explaining the purpose and function of the facility.

Although the recommended mitigation measures would reduce the visual contrasts of the EES facilities, proposed project impacts would still be considered significant.

4.13.12 Significant Unavoidable Impacts

Implementation of either Alternatives 1, 2, 3, or 4 would result in significant and unavoidable visual impacts. The massing, bulk, and color of the proposed evaporation ponds and EES facilities would result in moderate to strong visual contrasts with the existing desert landscape in the basin, as seen from key viewing observation points. Although mitigation measures have been identified that can reduce the effects of these impacts, proposed project impacts would still be considered significant.

4.14 PUBLIC HEALTH AND ENVIRONMENTAL HAZARDS

4.14.1 Summary of Environmental Consequences

Alternatives 1, 3, 4, and 5 would have potentially significant health and safety impacts. Construction activities at the former Salton Sea Test Base under these alternatives could expose construction workers to subsurface unexploded ordnance (UXO), work related traumatic injuries and heat stroke endangering their safety. This impact could be mitigated by consulting with the US Navy to determine what measures would be required to adequately reduce safety hazards at the potentially UXO-contaminated locations that would be disturbed by construction activities and by strict adherance to OSHA regulations.

Under the No Action Alternative with current inflows, some disease agents may find the changing environment inhospitable and others may find a new haven. Inflows to the Sea will continue to contain the nutrient loads and other materials that currently flow to the Sea. The effects on selenium-related health hazards from taking no action are not known. The No Action Alternative with reduced inflows would have similar effects as with current inflows. Construction activities under all restoration alternatives with current inflows could expose construction workers to biological pathogens and contaminated sediments, increase the potential for transmission of mosquito-borne diseases to humans, and slightly increase the potential for exposure to Sea water containing petroleum products that have been released by motorized vehicles and watercraft. In addition, alternatives involving in-sea construction could expose fish and duck consumers to sediment contaminants that are disturbed and introduced into the food chain. Under reduced inflow conditions, all alternatives would involve additional construction projects that may have effects similar to those described above. Operations under all restoration alternatives with current and reduced inflows could increase the potential health hazards associated with biological pathogens in Sea water, temporarily increase then decrease the potential for transmission of mosquito-borne diseases to humans, increase the number of individuals exposed to potential selenium-related health hazards present in fish and ducks, expose individuals to airborne contaminants present in sediment, and increase recreational use of the Sea, thereby exposing additional individuals to potential in-Sea hazards and increasing the amount petroleum products released into the Sea. In addition, the EES constructed for Alternative 2 may expose visitors to Bombay Beach to airborne concentrations of salts and selenium; the EES's to be constructed under Alternatives 3, 4, and 5 likely would not affect populated areas due to their distance from these areas. Under reduced inflows, the restoration alternatives would have effects similar to those described for current inflows. In addition, the north wetland habitat under Alternatives 1, 2, 3, and 4 could provide additional encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans. The effects of the restoration alternatives on selenium-related health hazards are not known. The cumulative wetland projects could increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans. The cumulative projects may slightly reduce the amount of selenium and other agricultural wastewater contaminants that enter the Sea, possibly reducing the levels of these contaminants in fish and ducks consumed by the public.

4.14.2 Significance Criteria

An alternative would have a significant impact to public health or be considered a significant environmental hazard if:

- It would cause an increase in airborne particulate material or other contaminants sufficient to cause human respiratory problems. Specific human health risk criteria would be based on standards identified in the air quality analysis.
- Soils would be contaminated with pesticides and fertilizers to the extent that they posed human health risks.
- Groundwater would be contaminated to the extent that it exceeded maximum contaminant levels established for public drinking water supplies or otherwise posed human health risks.
- Brine or contaminants would be exported to locations without comprehensive waste management regulations.
- The risk of accidental spills of contaminants that may cause human health risks would increase substantially.
- Construction activities posed a substantial risk to public safety.
- The risk of environmental hazards such as wildfires, floods, or earthquakes that could affect human health and safety would increase.
- Humans would be exposed to radiological or other hazardous substances.
- The potential for transmission of mosquito-borne diseases to humans would increase substantially.
- Recreational users of the Sea or fish consumers would be exposed to substantially increased levels of health hazards
- Wind erosion of exposed contaminated sediments would expose people to airborne health hazards

A "significant" impact is an adverse impact of sufficient magnitude or of such severity that it either would exceed existing regulatory standards affecting human health or otherwise result in major human health or safety risks through exposure to environmental hazard.

4.14.3 Assessment Methods

The environmental consequences section describes the potential human health effects from each alternative and the direct and indirect risks to human health from environmental hazards. The effects of project alternatives on public health and safety are analyzed by evaluating potential human health risks from each alternative, including the No Action Alternative, against baseline conditions in accordance with applicable federal, state, and local regulations and guidelines. Mitigation measures that could reduce the severity of identified adverse impacts are summarized in Section 4.14.11.

In addition, the cumulative impacts of other reasonably foreseeable projects that affect public health and environmental hazards within the study area are analyzed in combination with the No Action Alternative and the project alternatives. Cumulative effects are presented in Section 4.14.10, and the cumulative projects are described in Section 2.9. Mitigation measures that could reduce the magnitude of the identified adverse impacts are presented in Section 4.14.11.

4.14.4 No Action Alternative

Effect of No Action with Continuation of Current Inflow Conditions

As a result of taking no action, the chemical composition of the Sea would continue to change, including further increase in its salinity. The changes in chemical composition likely would decrease the survival rates of organisms in the Sea, including biological pathogens, reducing the potential health hazards associated with exposure to these pathogens. However, because the future chemical composition of the Sea cannot be accurately predicted, it cannot be known whether it would increase or decrease the survival rate of biological pathogens, such as fecal contaminants and Vibrio bacteria. Because fecal contaminants have finite lifespans, their presence in the Sea are dependent on a continuing source of new organisms. It can be assumed that the sources of these organisms, primarily municipal wastewater and animal waste, would remain unchanged under this alternative. Therefore, the future levels of fecal contaminants would be dependent on the effects of the changes in the Sea on their survival rates. The Vibrio bacteria are different from fecal contaminants in that they are naturally occurring organisms. However, the future levels of these organisms also are dependent on the effects of the changing chemical composition of the Sea on their survival rates. Due to uncertainty about the future levels of these biological pathogens, the change in health effects related to their presence cannot be known.

The increase in the water level of the Sea would expand the Sea's shoreline, which may slightly increase the amount of brackish marsh along the perimeter of the Sea. An increase in the amount of brackish marsh, which is breeding habitat for the encephalitis mosquito (*C. tarsalis*), could cause an expansion of the mosquito population, increasing the potential for human exposure to Western Equine Encephalomyelitis and St. Louis Encephalitis transmitted by that population. The continued monitoring and abatement of mosquito problems by the Coachella Valley Mosquito and Vector Control District (Riverside County) and the Imperial County Health Department would minimize the effects of increased mosquito breeding habitat.

Under this alternative, the Sea would continue to serve as a wastewater basin. The continued inflow of selenium-containing water from rivers and drains into the Sea would continue to introduce selenium into the Sea's food chain. Through the food chain, selenium would continue to accumulate in fish and waterfowl, which would have potential adverse health effects for people consuming fish and ducks from the Sea.

However, it is not known whether selenium levels in these animals would increase noticeably over baseline levels; the selenium present in food chain organisms may not be recycled through the food chain if the bodies of dead organisms are not fully broken down or if, in the case of waterfowl, death of the organism occurs outside the ecosystem. Selenium would continue to be removed from the water by in-Sea organisms and precipitation may play a larger role in the removal of selenium from Sea water as the increase in salinity decreases the solubility of selenium. As the Sea continues to degrade, it is likely that fewer anglers and hunters would be attracted to the Sea, reducing the number of individuals potentially exposed to selenium through consumption of fish and ducks. At some point, the Salton Sea would no longer support the fish species within it, the fishery would die off, and this human exposure pathway would be eliminated.

Effect of No Action with Reduced Inflows

Assuming a baseline of reduced inflow into the Salton Sea, this alternative would have effects similar to those described under no action with current inflows. The smaller Sea volume may create conditions that cause an accelerated decline of the fishery, leading to earlier elimination of human exposure to selenium through fish consumption.

4.14.5 Alternative 1

In this analysis, the Salton Sea is defined as that portion of the Sea that lies outside the evaporation ponds.

Effect of Alternative 1 with Continuation of Current Inflow Conditions

Short Term – Construction

Disturbance of Salton Sea Test Base property contaminated with unexploded ordnance (UXO) would not affect public safety, but could endanger the safety of workers constructing the evaporation ponds, resulting in a potential significant impact. This impact could be mitigated by consulting with the US Navy to determine what measures would be required to adequately reduce safety hazards at potentially UXO-contaminated locations that would be disturbed by construction activities.

Construction workers would be exposed to a number of potential health hazards throughout the construction period. Accidental ingestion or inhalation of Sea water could expose workers to biological pathogens present in the water, and physical contact with sediments being dredged could result in dermal exposure to contaminants present in the sediments.

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water. If these pockets of water remain undisturbed long enough for vegetation to grow, they would increase the amount of breeding habitat for the encephalitis mosquito, leading to an increase in the mosquito population. An increase in the mosquito population would increase the potential for transmission of mosquito-borne diseases to humans.

During construction of the evaporation ponds and the pupfish pond, bottom sediments would be disturbed, resulting in the possible dispersion of selenium and other contaminants accumulated on the Sea floor. The dispersion of these contaminants would increase their localized ambient concentrations in Sea water and could increase their levels in food chain organisms, increasing the potential for greater accumulation in fish and waterfowl. These increased concentrations would increase the potential health hazard for fish and duck consumers.

The use of heavy equipment and watercraft to construct the dikes and the export pipeline would increase the potential for accidental spills of petroleum products, primarily fuels and oils. Spills on land could be introduced into the Sea via stormwater runoff. The volume of any accidental spills compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Long Term – Operation

Comparison to No Action Conditions. Under this alternative, pathogen levels in the Salton Sea may increase in comparison to no action conditions. However, as stated above, the changes in pathogen levels cannot be accurately predicted for this alternative or the No Action Alternative.

The receding Sea level likely would reduce the amount of brackish marsh along the perimeter of the Sea. This reduction in mosquito breeding habitat would decrease the presence of mosquitoes at the Sea and reduce the potential for transmission of diseases from mosquitoes to humans.

The continued inflow of selenium-containing water from tributaries to the Sea would continue to introduce selenium into the Sea's food chain, which would have potential adverse health effects for people consuming fish and ducks from the Sea. However, it is not known whether selenium levels in these animals would increase noticeably over baseline levels; the selenium present in food chain organisms may not be recycled through the food chain if the bodies of dead organisms are not fully broken down or if, in the case of waterfowl, death of the organism occurs outside the ecosystem. Selenium would continue to be removed from the water by in-Sea organisms. Pumping of Sea water, which contains relatively low selenium concentrations, likely would remove negligible amounts of selenium from the food chain. Improving the condition of the fishery under this alternative may attract a greater number of anglers to the Sea, increasing the size of the population exposed to selenium via consumption of fish.

The decline in Sea elevation may expose contaminated sediments along the Sea's perimeter and increase the potential for public exposure to airborne contaminants due to wind erosion of the sediments. Because the potential for the exposed sediments to be affected by wind erosion is uncertain, as discussed in Section 4.4, the likelihood of unhealthful levels of sediment contaminants becoming airborne is unknown. Additionally, the amount of Sea level decline is relatively small, limiting the amount of bottom sediment that would be exposed.

If conditions at the Sea improve as a result of this alternative, recreational use of the Sea likely would increase and a greater number of people would exposed to potential hazards at the Sea. Increased recreational use also could lead to increased use of motorized watercraft at the Sea, increasing the amount of petroleum fuels and oils released into the Sea. The volume of these releases compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Because public access to the evaporation ponds and other ponds would be restricted, the public would not be exposed to the potential hazards associated with these ponds. Workers maintaining and studying the ponds likely would receive training on the various hazards associated with the ponds, including physical and chemical hazards, which would reduce the likelihood for accidents or exposures.

Effect of Alternative 1 with Reduced Inflow Conditions

Short Term – Construction

The short-term construction effects would be the same as those described for Alternative 1 with current inflows, with one exception. Construction of the displacement dike and the north wetland habitat would increase the magnitude of construction-related impacts.

Long Term – Operation

Comparison to No Action Conditions. The effects of this alternative would be similar to Alternative 1 with current inflows.

4.14.6 Alternative 2

In this analysis, the Salton Sea is defined as that portion of the Sea that lies outside the north wetland habitat. The proposed EES under this alternative would be constructed at Bombay Beach.

Effect of Alternative 2 with Continuation of Current Inflow Conditions

Short Term – Construction

Construction workers would be exposed to a number of potential health hazards during the in-Sea portion of the construction period. Accidental ingestion or inhalation of Sea water could expose workers to biological pathogens present in the water, and physical contact with sediments being dredged could result in dermal exposure to contaminants present in the sediments.

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water. If these pockets of water remain undisturbed long enough for vegetation to grow, they would increase the amount of breeding habitat for the encephalitis mosquito, leading to an increase in the mosquito population. An increase in the mosquito population would increase the potential for transmission of mosquito-borne diseases to humans.

The use of heavy equipment and watercraft to construct the EES would increase the potential for accidental spills of petroleum products, primarily fuels and oils. Spills on land could be introduced into the Sea via stormwater runoff. The volume of any accidental spills compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Long Term – Operation

Comparison to No Action Conditions. Under this alternative, pathogen levels in the Salton Sea may increase in comparison to no action conditions. However, as stated above, the changes in pathogen levels cannot be accurately predicted for this alternative or the no action alternative. The receding Sea level likely could reduce the amount of brackish marsh along the perimeter of the Sea. A reduction in mosquito breeding habitat would reduce the presence of mosquitoes at the Sea, reducing the potential for transmission of diseases from mosquitoes to humans. The continued inflow of selenium-containing water from tributaries to the Sea would continue to introduce selenium into the Sea's food chain, which would have potential adverse health effects for people consuming fish and ducks from the Sea. Pumping Sea water, which contains relatively low selenium concentrations, likely would remove negligible amounts of selenium from the food chain. Improving the condition of the fishery under this alternative may attract a greater number of anglers to the Sea, increasing the size of the population exposed to selenium via consumption of fish. The decline in Sea elevation may expose contaminated sediments along the Sea's perimeter and increase the potential for public exposure to airborne contaminants due to wind erosion of the sediments. If conditions at the Sea improve as a result of this alternative, recreational use of the Sea likely would increase and a greater number of people would exposed to potential hazards at the Sea. Increased recreational use also could lead to increased use of motorized watercraft at the Sea, increasing the amount of petroleum fuels and oils released into the Sea. The volume of these releases compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

These effects would be similar to those described for Alternative 2 compared to baseline conditions.

Effect of Alternative 2 with Reduced Inflow Conditions

Short Term – Construction

The short-term construction effects would be similar to those described for Alternative 2 under current inflows. The magnitude of effects would increase due to construction of the displacement dike and the north wetland habitat.

During construction of the north wetland habitat, bottom sediments would be disturbed, resulting in the possible dispersion of selenium and other contaminants accumulated on the Sea floor. The dispersion of these contaminants would increase their localized ambient concentrations in Sea water and could increase their levels in food chain organisms, increasing the potential for greater accumulation in fish and waterfowl. These increased concentrations would increase the potential health hazard for fish and duck consumers.

Long Term – Operation

Comparison to No Action Conditions. Compared to no action conditions, the effects of this alternative would be similar to those described for Alternative 2 under current inflows.

4.14.7 Alternative 3

In this analysis, the Salton Sea is defined as that portion of the Sea that lies outside the north wetland habitat. The proposed EES would be constructed at the Salton Sea Test Base Facility.

Short Term – Construction

Disturbance of Salton Sea Test Base property contaminated with UXO would not affect public safety, but could endanger the safety of workers constructing the EES, resulting in a potential significant impact. This impact could be mitigated by consulting with the US Navy to determine what measures would be required to adequately reduce safety hazards at potentially UXO-contaminated locations that would be disturbed by construction activities.

The other short-term effects of constructing the EES at the Salton Sea Test Base Facility would be similar to those described for Alternative 2. The magnitude of effects would be similar due to the same approximate footprint for the EES.

Long Term – Operation

Because the operational design of the EES at the Salton Sea Test Base Facility is the same as that for the EES north of Bombay Beach, the long-term operational effects of Alternative 3 would be the same as those described for Alternative 2, with one exception. Due to the proposed location of the EES under this alternative, it is not likely that populated areas at the Sea would be exposed to windborne salts, selenium, and other substances.

4.14.8 Alternative 4

In this analysis, the Salton Sea is defined as that portion of the Sea that lies outside the evaporation pond and the north wetland habitat. The proposed EES under this alternative would be constructed at the Salton Sea Test Base Facility.

Effect of Alternative 4 with Continuation of Current Inflow Conditions

Short Term – Construction

Disturbance of Salton Sea Test Base property contaminated with UXO would not affect public safety, but could endanger the safety of workers constructing the EES, resulting in a potential significant impact. This impact could be mitigated by consulting with the US Navy to determine what measures would be required to adequately reduce safety hazards at potentially UXO-contaminated locations that would be disturbed by construction activities.

Construction workers would be exposed to a number of potential health hazards throughout the construction period. Accidental ingestion or inhalation of Sea water could expose workers to biological pathogens present in the water, and physical contact with sediments being dredged could result in dermal exposure to contaminants present in the sediments.

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water. If these pockets of water remain undisturbed long enough for vegetation to grow, they would increase the amount of breeding habitat for the encephalitis mosquito, leading to an increase in the mosquito population. An increase in the mosquito population would increase the potential for transmission of mosquito-borne diseases to humans.

During construction of the evaporation pond and the pupfish pond, bottom sediments would be disturbed, resulting in the possible dispersion of selenium and other contaminants accumulated on the Sea floor. The dispersion of these contaminants would increase their localized ambient concentrations in Sea water and could increase their levels in food chain organisms, increasing the potential for greater accumulation in fish and waterfowl. These increased concentrations would increase the potential health hazard for fish and duck consumers.

The use of heavy equipment and watercraft to construct the EES would increase the potential for accidental spills of petroleum products, primarily fuels and oils. Spills on land could be introduced into the Sea via stormwater runoff. The volume of any accidental spills compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Long Term – Operation

Comparison to No Action Conditions. Under this alternative, pathogen levels in the Salton Sea may increase in comparison to no action conditions. However, as stated above, the changes in pathogen levels cannot be accurately predicted for this alternative or the No Action Alternative. The receding Sea level may slightly reduce the amount of brackish marsh along the perimeter of the Sea. A reduction in mosquito breeding habitat would reduce the presence of mosquitoes at the Sea, reducing the potential for transmission of diseases from mosquitoes to humans. The continued inflow of selenium-containing water from tributaries to the Sea would continue to introduce selenium into the Sea's food chain, which would have potential adverse health effects for people consuming fish and ducks from the Sea. Pumping Sea water, which contains relatively low selenium concentrations, likely would remove negligible amounts of selenium from the food chain. Improving the condition of the fishery under this alternative may attract a greater number of anglers to the Sea, increasing the size of the population exposed to selenium via consumption of fish. The decline in Sea elevation may expose contaminated sediments along the Sea's perimeter and increase the potential for public exposure to airborne contaminants due to wind erosion of the sediments. If conditions at the Sea improve as a result of this alternative, recreational use of the Sea likely would increase and a greater number of people would exposed to potential hazards at the Sea. Increased recreational use also could lead to increased use of motorized watercraft at the Sea, increasing the amount of petroleum fuels and oils released into the Sea. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low. Because public access to the evaporation pond would be restricted, the public would not be exposed to the potential hazards associated with these ponds. Workers maintaining and studying the ponds likely would receive training on the various hazards associated with the ponds, including physical and chemical hazards, which would reduce the likelihood for accidents or exposures.

These effects would be similar to those described for Alternative 4 compared to baseline conditions.

Effect of Alternative 4 with Reduced Inflow Conditions

Short Term – Construction

The short-term construction effects of this alternative would be similar to those described for Alternative 4 with current inflows. There would be additional effects from constructing the displacement dike and the north wetland habitat. The effects would be similar to the in-Sea construction effects described for Alternative 4 with current inflows.

During construction of the north wetland habitat, bottom sediments would be disturbed, resulting in the possible dispersion of selenium and other contaminants accumulated on the Sea floor. The dispersion of these contaminants would increase their localized ambient concentrations in Sea water and could increase their levels in food chain organisms, increasing the potential for greater accumulation in fish and waterfowl. These increased concentrations would increase the potential health hazard for fish and duck consumers.

Long Term – Operation

Comparison to No Action Conditions. Compared to no action conditions, the effects of this alternative would be similar to those described for Alternative 2 under current inflows.

4.14.9 Alternative 5

In this analysis, the Salton Sea is defined as that portion of the Sea that lies outside the evaporation pond and the north wetland habitat.

Effect of Alternative 5 with Continuation of Current Inflow Conditions

Short Term – Construction

Disturbance of Salton Sea Test Base property contaminated with UXO would not affect public safety, but could endanger the safety of workers constructing the evaporation ponds, resulting in a potential significant impact. This impact could be mitigated by consulting with the US Navy to determine what measures would be required to adequately reduce safety hazards at potentially UXO-contaminated locations that would be disturbed by construction activities.

Construction workers would be exposed to a number of potential health hazards throughout the construction period. Accidental ingestion or inhalation of Sea water could expose workers to biological pathogens present in the water, and physical contact with sediments being dredged could result in dermal exposure to contaminants present in the sediments.

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water. If these pockets of water remain undisturbed long enough for vegetation to grow, they would increase the amount of breeding habitat for the encephalitis mosquito, leading to an increase in the mosquito population. An increase in the mosquito population would increase the potential for transmission of mosquito-borne diseases to humans.

During construction of the in-Sea EES pond and north wetland habitat, bottom sediments would be disturbed, resulting in the possible dispersion of selenium and other contaminants accumulated on the Sea floor. The dispersion of these contaminants would increase their localized ambient concentrations in Sea water and could increase their levels in food chain organisms, increasing the potential for greater accumulation in fish and waterfowl. These increased concentrations would increase the potential health hazard for fish and duck consumers.

The use of heavy equipment and watercraft to construct the dikes and the export pipeline would increase the potential for accidental spills of petroleum products, primarily fuels and oils. Spills on land could be introduced into the Sea via stormwater runoff. The volume of any accidental spills compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Long Term – Operation

Comparison to No Action Conditions. Under this alternative, pathogen levels in the Salton Sea may increase in comparison to no action conditions. However, as stated above, the changes in pathogen levels cannot be accurately predicted for this alternative or the No Action Alternative. The receding Sea level may slightly reduce the amount of brackish marsh along the perimeter of the Sea. A reduction in mosquito breeding habitat would reduce the presence of mosquitoes at the Sea, reducing the potential for transmission of diseases from mosquitoes to humans. The continued inflow of selenium-containing water from tributaries to the Sea would continue to introduce selenium into the Sea's food chain, which would have potential adverse health effects for people consuming fish and ducks from the Sea. Pumping Sea water, which contains relatively low selenium concentrations, likely would remove negligible amounts of selenium from the food chain. Improving the condition of the fishery under this alternative may attract a greater number of anglers to the Sea, increasing the size of the population exposed to selenium via consumption of fish. The decline in Sea elevation may expose contaminated sediments along the Sea's perimeter and increase the potential for public exposure to airborne contaminants due to wind erosion of the sediments. Drift of Sea water and its constituents resulting from operation of the EES would not likely result in public exposure to these substances. If conditions at the Sea improve as a result of this alternative, recreational use of the Sea likely would increase and a greater number of people would exposed to potential hazards at the Sea. Increased recreational use also could lead to increased use of motorized watercraft at the Sea, increasing the amount of petroleum fuels and oils released into the Sea. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low. Because public access to the evaporation pond would be restricted, the public would not be exposed to the potential hazards associated with these ponds. Workers maintaining and studying the ponds likely would receive training on the various hazards associated with the ponds, including physical and chemical hazards, which would reduce the likelihood for accidents or exposures.

These effects would be similar to those described for Alternative 5 compared to baseline conditions.

Effect of Alternative 5 with Reduced Inflow Conditions

Short Term – Construction

The short-term construction effects of this alternative would be similar to those described for Alternative 5 with current inflows. There would be additional effects from constructing the displacement dike. The effects of construction would be similar to the in-Sea construction effects described for Alternative 5 with current inflows.

Long Term – Operation

Comparison to No Action Conditions. Compared to no action conditions, this alternative would have similar to those described for Alternative 5 with current inflows.

4.14.10 Cumulative Effects

Construction of the Lewis Drain Treatment Facility and continued operation of the Duck Club Evaporative Ponds would remove selenium, nutrients, and pesticides from agricultural wastewater and prevent these contaminants from entering the Sea. The Brawley Wetlands Construction Project and Brawley Wetlands Research Facility would remove contaminants from agricultural wastewater and the New River, possibly reducing contaminant loading to the Sea. The potential reduction in selenium levels entering the Sea resulting from the cumulative projects may reduce selenium in fish and waterfowl, resulting in beneficial health effects for fish and duck consumers. The wetlands projects likely would increase breeding habitat for the encephalitis mosquito, thus increasing the potential for transmission of diseases from mosquitoes to humans.

4.14.11 Mitigation Measures

To mitigate the potential significant impact resulting from disturbance of subsurface UXO, the US Navy should be consulted to determine what measures would be required to adequately reduce safety hazards at potentially UXO-contaminated locations that would be disturbed by construction activities.

The following measures are recommended to reduce or minimize the identified adverse effects.

- A fish sampling and monitoring protocol has been prepared by the Salton Sea Science Subcommittee to provide updated information for agency use in evaluating the fish advisory; however, this protocol requires regulatory agency approval before it can be implemented.
- To reduce the potential health risks from elevated levels of selenium in ducks and any other waterfowl consumed by humans, samples of these species should be collected periodically by agencies with public health responsibility, safe consumption levels should be established, and the public should be notified of these levels.
- To minimize the effects of in-Sea construction activities, the analytical results from sampling bottom sediments at the locations of the proposed dikes should be evaluated to determine the potential for sediment dispersion. The planned use of silt barriers would reduce dispersion. However, if these silt barriers would not adequately reduce the release of sediment contaminants, including selenium, then additional engineering controls should be designed and implemented to minimize dispersion.
- Breeding habitat for nuisance species of mosquitoes could be minimized by applying insect growth regulators to standing water resulting from project construction or operation or ensuring that such standing water does not remain undisturbed for greater than three days.
- To reduce the effects of construction activities, spill prevention and spill response plans should be prepared and implemented to minimize the potential for spills and reduce the effects of any spills that do occur.

4.14.12 Potentially Significant Unavoidable Impacts

No potentially significant unavoidable impacts to public health and environmental hazards have been identified.

4.15 PUBLIC SERVICES AND UTILITIES

4.15.1 Summary of Environmental Consequences

The only significant effect anticipated for any alternative is related to traffic impacts during the construction of the concentration ponds. Approximately 1,000 truck trips per day are anticipated on SR 86, using a traffic control system to stop vehicles on the highway. This would cause significant delays, the severity of which would depend on the timing of the deliveries.

No other significant impacts to public services or utilities are anticipated. The amount of water required for constructing the concentration ponds and EES would be minimal. Wastewater services for the construction effort would be provided by portable facilities. Electrical services for the construction effort would be provided by portable generators. Materials dredged from the project site for constructing concentration ponds would be discharged to the Sea. A minimal amount of other construction debris would be generated. Salts accumulated at the EES would be disposed of in the Sea or at an approved landfill. The amount of salts disposed of at local landfills is expected to be minor.

The construction of concentration ponds and Enhanced Evaporation Systems would cause commute trips for construction workers between their homes and the work sites. These new trips added to existing traffic patterns would change the LOS as would vehicle trips associated with the construction. Heavy construction vehicles hauling borrow material, precipitating salts, and roadway construction materials would affect the levels of service on two-lane roads and at intersections. The impacts would be more significant on roadway grades.

The construction of haul roads, pipelines, and boatramp access roads would cause temporary closures and detours when borrow materials cross SR 86, when a pipeline is built under SR 111, and when access roads are resurfaced or reconstructed.

A small number of construction workers and their families would move to the project area temporarily. However, this is not expected to generate significant population growth or significant demand for local utility services or public service providers.

4.15.2 Significance Criteria

The following criteria have been used to evaluate the significance of impacts to utilities:

- The degree to which the increased demands from the proposed program would require the development of additional capacity or new facilities;
- The degree to which increased demands from the proposed program would reduce the reliability of utility service or transportation systems or would aggravate existing adverse conditions; and
- The degree of damage to underground utilities that could be caused by construction or operation activities.

The following criteria have been used to evaluate the significance of impacts on public services:

- The degree to which traffic related to the proposed project would increase traffic volumes in relation to roadway capacity, resulting in a reduction in the LOS;
- The degree to which increases in population related to the proposed project would reduce service levels of police and fire services below locally prevailing conditions or would require additional personnel or facilities that are not expected to be available;
- The degree to which increases in population would reduce public education service levels below legally mandated student-to-teacher ratios.

4.15.3 Assessment Methods

Utilities

The utility demands have been determined based on estimated construction and operation needs of the proposed restoration alternative (direct demand). In addition, projected area population and recreational use increases related to the construction and operation of the restoration alternative have been considered (indirect demand). The utility systems addressed in the analysis would be the facilities and infrastructure used for potable water (pumping, treatment, storage, and distribution), wastewater (collection and treatment), solid waste facilities, and electricity generation and distribution.

The potential effects of restoration alternatives have been evaluated by estimating and comparing the additional direct and indirect demand associated with each alternative to the existing and projected operating capabilities of each utility system.

Public Services

Traffic. The analysis of potential impacts to traffic focuses on roadways that provide direct access to the project site and on regional links to the Salton Sea area. The ROI for the transportation analysis includes major highways in Riverside and Imperial counties, with emphasis on the area surrounding the Salton Sea.

The number of vehicle trips expected as a result of the proposed restoration alternative has been estimated for construction and operation scenarios. Estimated vehicle trips have been allocated to the local road network using expected destinations and sources for trips. The transportation network has been examined to identify potential impacts to LOS.

Public Education, Police Protection, and Fire Protection. Projected increases in demand for public services are based on population increases. Increases in population would affect school enrollments and would require fire protection and police services from local providers.

4.15.4 No Action Alternative

No significant impacts on public services or utilities are expected with either the No Action Alternative with continuation of current inflow conditions or with the No Action Alternative with reduced inflows. With both scenarios, existing demands on public services and utilities would continue, and there would be no project-related demand on these systems. As the Sea declines, recreational use and the demands associated with it would decrease. No significant impacts are anticipated for water resources with reduced inflows because the proposed transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area.

Effect of No Action Alternative with Continuation of Current Inflow Conditions

With the No Action Alternative, existing demands on public services and utilities would continue. There would be no project-related demand, and increases in demand related to increased recreational uses and economic development would not occur. As the Sea declines, recreational use and the commercial enterprises that support this recreational use would decrease, resulting in decreased local demand for utilities and public services.

Effect of No Action Alternative with Reduced Inflows (1.06 maf/yr)

The effects of the No Action Alternative with Reduced Inflows would be the same as those discussed for the No Action Alternative with current inflows for all utilities and public services except for water. However, no significant impacts are expected for water service in the project area because the proposed water transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area.

4.15.5 Alternative 1

Traffic delays related to truck traffic crossing Highway 86 using a traffic control device would be significant. The effects of Alternative 1 with current inflow conditions on all other utilities and public services would not be significant. Alternative 1 with reduced inflow conditions would result in slightly larger construction impacts.

Effect of Alternative 1 with Current Inflow Conditions

Utilities

Water Service. Short-term, construction-related impacts on water service provided by the IID and CVWD would be less than significant. As discussed in the socioeconomics section, the local labor force would not be sufficient to provide all of the construction labor required for this project. Workers and their families would move to the area for the 48-month construction period. This small increase in demand would not cause significant stress on the local water supply. No significant increase in recreational use of the Sea is expected during Phase I of this alternative. Therefore, demand for water related to recreational uses would remain at current levels.

Approximately 38,000 gallons per day of water would be used during the construction period. This water would be obtained from either the Sea or the local water supply. The water required would be approximately 0.15 percent of the total water demand for IID in 1997. Therefore, a less than significant impact would occur.

Wastewater Service. Wastewater services for the construction effort would be provided by portable facilities. Therefore, no impacts would occur on local wastewater systems. The small number of construction workers and their families that would temporarily move to the project area would connect to the appropriate wastewater system or septic sewer. No significant effects are anticipated from this minor temporary increase in population. No significant increase in recreational use of the Sea is expected during Phase I of Alternative 1. Therefore, demand for wastewater service related to recreational uses would remain at current levels.

Electrical Service. Electrical services for the construction effort would be provided by portable generators. The demand for electricity would be minimal and would be generated by the operation of various construction equipment. The small number of construction workers and their families that would temporarily move to the project area would not cause a significant increase in the demand for electrical service. No significant increase in recreational use of the Sea is expected during Phase I of Alternative 1. Therefore, demand for electricity related to recreational uses would remain at current levels.

Operation of the evaporation ponds and the Pupfish Pond entails pumping water from the Salton Sea into the impoundments. The demand for electricity is expected to be minimal; however, these estimates will be refined in the final design phase.

Solid Waste Disposal Facilities. Materials dredged from the project site would be discharged to the Sea and would not affect local landfills. A minimal amount of other construction debris would be generated during the construction period and would be hauled to a designated landfill.

Public Services

Traffic. There would be impacts to SRs 78, 86, and 111 as construction workers commute from Brawley and other nearby communities to the construction sites. As part of the pond construction, borrow material would be hauled on a dedicated road that runs parallel and west of SR 86. The material would cross SR 86 at two locations with the aid of a traffic control system, which would disrupt traffic flow on SR 86 during the 48-month construction period. Because an average of 1,000 daily truck trips is estimated, this would cause significant delays on SR 86. No increase in recreational use of the Sea is expected over the operation of this alternative. Therefore, traffic related to recreational uses would remain at current levels.

Public Education. The small number of construction workers and their families that would temporarily move to the project area would not cause a significant increase in the number of school-age children.

Police Services. Police services in the project area would be provided by the Imperial County Sheriff's Department. Basic security measures, such as installing fencing and lighting, locking equipment, and providing security patrols should minimize any attractive nuisances at the construction site. No significant impacts on police services are anticipated. No significant increase in recreational use of the Sea is expected during Phase I of Alternative 1. Therefore, demand for police services related to recreational uses would remain at current levels.

Fire Services. Fire services in the project area would be provided by the Imperial County Fire Department and Office of Emergency Services. Permanent structures related to the concentration ponds would be earthen and would not result in an increase in fire hazard. No significant impacts are anticipated. No significant increase in recreational use of the Sea is expected during Phase I of Alternative 1. Therefore, demand for fire services related to recreational uses would remain at current levels.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

Reduction of inflows to 1.06 maf per year would result in the same impacts. Impacts to traffic could be greater. These impacts would be related to the construction of the north wetland habitat and the displacement dike. Fill material for the north wetland habitat may be carried on the existing highway system. Material for the displacement dike would be carried on a dedicated haul road that extends south on the west side of SR 86. A traffic control system will facilitate trucks crossing the highway at a point approximately 45 kilometers from the borrow site near the southern boundary of the Sonny Bono National Wildlife Refuge. The proposed water transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area.

Operational demand for electricity would increase with the additional pumping for the North Wetland Habitat. This increase is expected to have minimal impact on electrical services; however, these estimates will be refined in the final design phase.

Workers and their families would move to the area for the 48-month construction period. This small, temporary increase in demand would not cause significant stress on local utilities or public services. No significant increase in recreational use of the Sea is expected during Phase I of this alternative. Therefore, demand for utilities and public services related to recreational uses would remain at current levels.

4.15.6 Alternative 2

High-power lines and towers would need to be relocated with this alternative. With mitigation, no significant impact is expected. No other significant impacts are anticipated with any other public service or utility. Impacts would be the same for current inflow and reduced inflow conditions.

Effect of Alternative 2 with Current Inflow Conditions

Water Service, Wastewater Service, Electrical Service, and Solid Waste Disposal Facilities. The construction-related impacts for the EES north of Bombay Beach would be similar to those described for the concentration ponds and would not be significant. High-power (240-kV) lines and towers traverse the site and would need to be relocated. With mitigation, no significant impact is anticipated. Salts accumulated during the enhanced evaporation process would be disposed of on the site. Therefore, local landfills would not be affected.

Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for water, wastewater service, and electricity. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Traffic. The EES would require a pipeline to be built under SR 111 and a parallel railroad. When this pipeline is constructed, it would cause temporary road closures and detours.

New vehicle trips would occur on SRs 78, 86, and 111 from construction material delivery trucks and workers commuting to the construction sites to build evaporation towers, install the pipeline and relocate the high-power lines and supporting towers.

Recreational use would increase during the operation of the EES, resulting in a slight increase in traffic on local roads. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Public Education. The small number of construction workers and their families that may move to the project area would not cause a significant increase in the number of school-age children. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Police Services. Police services in the project area would be provided by the Imperial County Sheriff's Department. Basic security measures, such as installing fencing and lighting, locking equipment, and providing security patrols should minimize any attractive nuisance at the construction site. No significant impacts on police services are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for police services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Fire Services. Fire services in the project area would be provided by the Imperial County Fire Department and Office of Emergency Services. Permanent structures related to the concentration ponds would be earthen and would not result in an increase in fire hazard. No significant impacts are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for fire services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Reduction of inflows to 1.06 maf per year would result in the same impacts. Impacts to traffic could be greater. These impacts would be related to the construction of the north wetland habitat and the displacement dike. Material for the displacement dike would be carried on a dedicated haul road that extends south on the west side of SR 86. A traffic control system will facilitate trucks crossing the highway at a point approximately 45 kilometers from the borrow site near the southern boundary of the Sonny Bono National Wildlife Refuge. Since no additional dedicated hauling roads have been designated, fill material for the north wetland habitat may be carried on the existing highway system. The proposed water transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area. The increased demand for electricity due to pumping required for operation of the North Wetland Habitat is expected to have a minimal effect on electrical services.

Some workers and their families would move to the area for the 48-month construction period. This small, temporary increase in demand would not cause significant stress on local utilities or public services.

4.15.7 Alternative 3

Power lines would need to be relocated with this alternative. With mitigation, no significant impact is expected. No other significant impacts are anticipated with any other public service or utility. Impacts would be the same for current inflow and reduced inflow conditions.

Effect of Alternative 3 with Current Inflow Conditions

Water Service, Wastewater Service, Electrical Service, and Solid Waste Disposal Facilities. The construction- and operation-related impacts for the EES at the former test base would be similar to those described for EES at Bombay Beach and would not be significant. A power line traverses the site and would need to be relocated. With mitigation, no significant impact is anticipated.

Recreational use would increase during the operation of the EES, resulting in a slight increase in demand on utilities. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Traffic. As noted above, the impacts would be caused by trucks hauling construction materials and construction worker traffic. The impacts would be focused on SRs 86 and 78 because the location of the EES is on the former test base.

Recreational use would increase during the operation of the EES, resulting in a slight increase in traffic on local roads. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Public Education, Police Services, and Fire Services. Impacts related to construction and operation of the EES at the former Salton Sea Test Base Facility would be the same as those discussed for the EES north of Bombay Beach. No significant impacts are anticipated.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of Alternative 3 and reduced inflows would be the same as those discussed for Alternative 2 with reduced inflow conditions for all utilities and public services.

4.15.8 Alternative 4

Traffic delays related to truck traffic crossing SR 86 using a traffic control device would be significant. Power lines and towers would need to be relocated with this alternative. With mitigation, no significant impact is expected. No other significant impacts are anticipated with any other public service or utility. Impacts would be the same for current inflow and reduced inflow conditions.

Effect of Alternative 4 with Current Inflow Conditions

Water Service, Wastewater Service, Electrical Service, and Solid Waste Disposal Facilities. The combined construction-related impacts for the EES at the former test base and the concentration pond would result from the small construction-related energy requirement and minor number of workers that would temporarily relocate to the project area. None of these impacts would be significant. A power line that traverses the EES would need to be relocated. With mitigation, no significant impact is anticipated. Salts accumulated during the enhanced evaporation process would be disposed of on the site. Therefore, local landfills would not be affected.

Operation of the evaporation pond and the Pupfish Pond entails pumping water from the Salton Sea into the impoundments. The demand for electricity is expected to be minimal; however, these estimates will be refined in the final design phase.

Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for water, wastewater service, and electricity. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Traffic. There would be impacts to SRs 78, 86, and 111 as construction workers commute from Brawley and other nearby communities to the construction sites. As part of the pond construction, borrow material would be hauled on a dedicated road that runs parallel and west of SR 86. The material would cross the highway at a traffic control system, which would disrupt traffic flow on SR 86 during the 48-month construction period. Because an average of 1,000 daily truck trips is estimated, this would cause significant delays on SR 86.

The EES would require a pipeline to be built under SR 111 and a parallel railroad. When this pipeline is constructed, it would cause temporary road closures and detours.

New vehicle trips would occur on SRs 78, 86, and 111 when workers commute to the construction sites to build evaporation towers, install the pipeline, and relocate the high-power lines and supporting towers.

Recreational use would increase during the operation of the EES, resulting in a slight increase in traffic on local roads. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Public Education. The small number of construction workers and their families that may move to the project area would not cause a significant increase in the number of school-age children. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Police Services. Police services in the project area would be provided by the Imperial County Sheriff's Department. Basic security measures, such as installing fencing and lighting, locking equipment, and providing security patrols should minimize any attractive nuisance at the construction site. No significant impacts on police services are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for police services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Fire Services. Fire services in the project area would be provided by the Imperial County Fire Department and Office of Emergency Services. Permanent structures related to the concentration ponds would be earthen and would not result in an increase in fire hazard. No significant impacts are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for fire services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

Reduction of inflows to 1.06 maf per year would result in the same impacts. Impacts to traffic could be greater. These impacts would be related to the construction of the north wetland habitat and the displacement dike. Fill material for the north wetland habitat may be carried on the existing highway system. Material for the displacement dike would be carried on a dedicated haul road that extends south on the west side of SR 86. A traffic control system will facilitate trucks crossing the highway at a point approximately 45 kilometers from the borrow site near the southern boundary of the Sonny Bono National Wildlife Refuge. The proposed water transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area. The increased demand for electricity due to the pumping requirements of the North Wetland Habitat is expected to have a minimal effect on electrical services.

Some workers and their families would move to the area for the 48-month construction period. This small, temporary increase in demand would not cause significant stress on local utilities or public services.

4.15.9 Alternative 5

Traffic delays related to truck traffic crossing SR 86 using a traffic control device would be significant. No other significant impacts are anticipated to any other public service or utility. Impacts would be the same for current inflow and reduced inflow conditions.

Effect of Alternative 5 with Current Inflow Conditions

Water Service, Wastewater Service, Electrical Service, and Solid Waste Disposal Facilities. The combined construction-related impacts for the EES in the concentration pond would result from the small construction-related energy requirement and minor number of workers that would temporarily relocate to the project area. None of these impacts would be significant. Salts accumulated during the enhanced evaporation process would be disposed of on the site. Therefore, local landfills would not be affected. The increased demand for electricity due to pumping requirements for the North Wetland Habitat is expected to have a minimal effect on electrical services.

Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for water, wastewater service, and electricity. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Traffic. There would be impacts to SRs 78, 86, and 111 as construction workers commute from Brawley and other nearby communities to the construction sites. As part of the pond construction, borrow material would be hauled on a dedicated road that runs parallel and west of SR 86. The material would cross the highway at a traffic control system, which would disrupt traffic flow on SR 86 during the 48-month construction period. Because an average of 1,000 daily truck trips is estimated, this would cause significant delays on SR 86.

New vehicle trips would occur on SRs 78, 86, and 111 when workers commute to the construction sites to build evaporation towers, install the pipeline, and relocate the high-power lines and supporting towers.

Recreational use would increase during the operation of the EES, resulting in a slight increase in traffic on local roads. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Public Education. The small number of construction workers and their families that may move to the project area would not cause a significant increase in the number of school-age children. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Police Services. Police services in the project area would be provided by the Imperial County Sheriff's Department. Basic security measures, such as installing fencing and lighting, locking equipment, and providing security patrols should minimize any attractive nuisance at the construction site. No significant impacts on police services are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for police services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Fire Services. Fire services in the project area would be provided by the Imperial County Fire Department and Office of Emergency Services. Permanent structures related to the concentration ponds would be earthen and would not result in an increase in fire hazard. No significant impacts are anticipated. Recreational use would increase during the operation of the EES, resulting in a slight increase in demand for fire services. Any impacts resulting from major development related to increased recreational opportunities at the Salton Sea (e.g., hotels and residential subdivisions) would be analyzed in a separate environmental document.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Reduction of inflows to 1.06 maf per year would result in the same impacts. Impacts to traffic could be greater. These impacts would be related to the construction of the displacement dike. Material for the displacement dike would be carried on a dedicated haul road, which extends south on the west side of SR 86. A traffic control system will facilitate trucks crossing the highway at a point approximately 45 kilometers from the borrow site near the southern boundary of the Sonny Bono National Wildlife Refuge. This would disrupt traffic flow on SR 86 during the 48-month construction period. The proposed water transfer program would transfer conserved water and would not reduce the amount of water available for water service in the project area.

Some workers and their families would move to the area for the 48-month construction period. This small, temporary increase in demand would not cause significant stress on local utilities or public services.

4.15.10 Cumulative Effects

Cumulative effects of regional projects and the Salton Sea restoration are not expected to be significant. The largest water demands would be short-term, during the construction period and should not be affected by the California 4.4 Plan. The IID water transfer program and canal lining projects would transfer conserved water only. Beneficial impacts would occur with the construction of the Mesquite Regional Landfill and Heber Wastewater Treatment System, which would expand the capacity of solid waste and wastewater systems in the region.

4.15.11 Mitigation Measures

Electrical utilities that must be removed for project components would be replaced in kind. Replacement facilities would be constructed on relocated sites in advance of the planned demolition of existing facilities in a manner where the down time of relocated facilities is kept to a minimum.

The work shifts for construction workers will be scheduled so that commuting times do not coincide with regular work time schedules for other daily commuters.

Trucks hauling construction materials to the concentration ponds would be scheduled outside rush hours to minimize the effects of the traffic control system on SR 86. Trucks hauling construction materials to other sites and precipitated salts to landfills also will be scheduled outside the rush hours to avoid local commuter traffic.

4.15.12 Potentially Significant Unavoidable Impacts

The only potentially significant unavoidable impact anticipated for any alternative is related to traffic impacts during the construction of the concentration ponds. A traffic control system to stop vehicles on the SR 86 would cause significant delays, the severity of which would depend on the timing of the deliveries.

No potentially significant unavoidable impacts are anticipated for any other public service or utility for any alternative.

4.16 CULTURAL RESOURCES

4.16.1 Summary of Environmental Consequences

Archaeological and Architectural Resources

Significant impacts to archaeological resources with the No Action Alternative could occur due to changes in the current elevation of the Salton Sea. Significant but mitigable impacts would occur with alternatives 1, 2, 3, 4, and 5 from construction activities, dredging in the Salton Sea, and by exposure or inundation of archaeological sites.

Ethnographic Resources

No impacts to ethnographic resources are expected with the No Action Alternative. Significant impacts could occur with alternatives 1, 2, 3, 4, and 5 from the disturbance submerged resources considered to be sacred by the Torres Martinez Desert Cahuilla, or any other Native American group contacted.

4.16.2 Significance Criteria

Archaeological and Architectural Resources

Criteria for evaluating the significance of impacts to archaeological and architectural resources are provided in CEQA and in 36 CFR § 800, the regulations implementing Section 106 of the NHPA. 36 CFR § 800.9 [a] and [b] state that an undertaking has an effect on a historic property (i.e., a resource eligible for the National Register of Historical Places [NRHP]) when that undertaking may alter those characteristics of the property that qualify it for inclusion in the NRHP. An undertaking is considered to have an adverse effect on a historic property when it may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include, but are not limited to the following:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property or alteration of the character of the property's setting when that character contributes to the property's qualifications for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or changes that may alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of a property without adequate provisions to protect the property's historic integrity.

Cultural resources that have been determined ineligible for inclusion in the NRHP could experience adverse effects, but they would not be considered significant unless they were resources regulated by the American Indian Religious Freedom Act or the Native American Graves Protection and Repatriation Act.

Section 15064.5 of CEQA states that a project may have a significant effect on the environment when the project may cause a substantial adverse change in the significance of a historical resource (i.e., resource eligible for the CRHR or a local register of historical resources). A substantial adverse change is defined as the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the historical resource would be materially impaired.

Ethnographic Resources

Section 101(d)(6)(A) of the NHPA, as amended (1992), allows for properties of traditional, religious, and cultural importance to a Native American tribe to be determined eligible for inclusion in the NRHP. Criteria for these TCPs are provided in National Register Bulletin 38: Guidelines for Evaluating and Documenting Traditional Cultural Properties (Parker and King 1990). Some TCPs also may qualify as sacred sites, as defined in Executive Order (EO) 13007. EO 13007 directs federal agencies, to the extent practical, permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and use of sacred sites and to avoid adversely affecting their physical characteristics. An action that alters a characteristic of a TCP, sacred site, or other ethnographic resource that is perceived by a tribal member as contributing to the importance of that resource, would be considered to have a significant effect on that resource. The significance of an effect to an ethnographic resource is determined based on the importance of the resource to the specific Native American group(s) involved and the type of effect the project will have. Given the character of ethnographic resources, in addition to potential impacts to the physical integrity of these resources, consideration also must be given to potential impact on the cultural setting of the resource. Because of the elevated cultural sensitivity and significance of ethnographic resources, impacts to these resources are oftentimes difficult, if not impossible, to mitigate.

4.16.3 Assessment Methods

Archaeological and Architectural Resources

Impact assessments for archaeological and architectural resources are based on the type of site, NRHP-eligibility status, the type of impact, and the extent of disturbance from the project. Impacts to these resources are considered significant if the project could adversely affect those sites determined eligible or potentially eligible for the NRHP.

Ethnographic Resources

Impact assessments for ethnographic resources are based on the type of resource, its perceived importance to the community, the type of impact, and the extent of disturbance from the project. Impacts to ethnographic resources are considered significant if the project would affect any quality of the resource that, in the eyes of tribal members, qualified it for listing on the NRHP. Impacts to sacred sites are considered significant if they result in a reduction or loss of access to the site, or if they introduce elements that interfere with the conduct of activities typically carried out at the site.

4.16.4 No Action Alternative

Significant impacts as well as benefits to archaeological and architectural resources and ethnographic resources may occur with the No Action Alternative. These effects are related to fluctuations in the level of the Salton Sea.

Effect of No Action Alternative with Current Inflow Conditions

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015, the level of the Sea would rise by 2 feet. Archaeological sites near the current shoreline would be inundated, subjecting them to significant impacts from currents and high salinity levels of the water.

Ethnographic Resources. No ethnographic resources, TCPs, or sacred sites have been identified that would be affected by the No Action Alternative with current inflow conditions.

Effect of No Action Alternative with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 1 foot to –228 feet mean sea level (msl). Exposure of presently submerged cultural resources could have both beneficial and adverse significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Ethnographic Resources. The Torres Martinez have expressed concern that the Salton Sea currently submerges sites they consider sacred. Beneficial and adverse impacts to ethnographic resources may occur if any currently inundated sacred sites are exposed. Exposure of these sites could be a benefit to the tribe by regaining access to lost sacred sites. Exposure could also be detrimental to these sites if they are not protected from vandalism.

4.16.5 Alternative 1

Significant but mitigable impacts to archaeological and architectural resources and ethnographic resources may occur from construction activities, dredging, and from archaeological sites becoming inundated or exposed by changes in elevation of the Salton Sea.

Effect of Alternative 1 with Current Inflow Conditions

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015, the level of the Sea would rise by 3 feet. Archaeological sites near the current shoreline would be inundated, subjecting them to significant impacts from currents and high salinity levels of the water.

Significant but mitigable impacts to archaeological resources could also occur from the construction and other activities related to the Northwest and Southwest Evaporation

Ponds. While most of the Northwest Evaporation Pond area is currently submerged and only 1.2% of the total Pond area has been surveyed for archaeological resources, 2 precontact archaeological sites are known in the project area. Most of the Southwest Evaporation Pond area is currently submerged and less than 1% of this Pond has been surveyed for archaeological resources. There is a high potential for additional archaeological sites to exist within the unsurveyed portions of the project area. All unsurveyed portions of the project area must be surveyed prior to any ground-disturbing activities. Identified resources must be evaluated for eligibility to the NRHP. Impacts to any NRHP-eligible resources would be considered significant.

Significant but mitigable impacts to archaeological resources could also occur from the construction and other activities related to the Pupfish Pond. While no cultural resources have been recorded in the area, significant impacts to previously unknown or submerged archaeological sites could occur from dredging activities.

For both Evaporation Ponds, as well as the Pupfish Pond, significant impacts to archaeological sites could also occur from dredging activities. Also, procurement of riprap and embankment material, and the construction of the haul road could also significantly impact presently known as well as unrecorded cultural resources.

In summary, two archaeological sites are currently known in the area of potential effect (APE). Both known and unknown cultural resources may be affected by three separate construction actions, and by rising Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 1; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea that they consider to be sensitive resources. The exact locations of these sites are unknown, but it is possible that such sites could be affected by dredging or construction activities. No ethnographic resources have been identified at the borrow or riprap sources that would be used for construction of the ponds.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015, the level of the Sea would rise by 2 feet. Archaeological sites near the current shoreline would be inundated, subjecting them to significant impacts from currents and high salinity levels of the water.

Other significant impacts are the same as described for the Alternative 1 with current inflow conditions, but with several additional effects. Significant but mitigable impacts to archaeological resources could occur from the construction and other activities related to the Displacement Dike, the North Shorebird Pond. One archaeological site is previously recorded from the Displacement Dike project area, and none of this APE has been surveyed for cultural resources. No surveys for cultural resources and no previously identified resources exist for the North Shorebird Pond. However, significant impacts to previously unknown or submerged archaeological sites could occur during construction or dredging activities.

There is a high potential for additional archaeological sites to exist within the unsurveyed portions of the project area. All unsurveyed portions of the project area must be surveyed prior to any ground-disturbing activities. Identified resources must be evaluated for eligibility to the NRHP. Impacts to any NRHP-eligible resources would be considered significant. Furthermore, procurement of riprap and embankment material, and the construction of the haul road could also significantly impact known and currently unrecorded cultural resources.

In summary, three archaeological sites are currently known in the APE. Both known and unknown cultural resources may be affected by six separate construction actions, and by fluctuating Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. Impacts to ethnographic resources are the same as described for the current inflow conditions.

4.16.6 Alternative 2

Significant but mitigable impacts to archaeological and architectural resources and ethnographic resources may occur from construction activities, dredging, and from archaeological sites becoming exposed by changes in elevation of the Salton Sea.

Effect of Alternative 2 with Current Inflow Conditions

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 2 feet to –229 feet msl. Exposure of presently submerged cultural resources could have both beneficial and negative significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant but mitigable impacts would occur if construction or other activities associated with the EES at Bombay Beach disturb cultural resources. Five archaeological sites have been identified within the Bombay Beach EES project area, yet only 2.7 percent of this area has been surveyed for cultural resources. Construction of the EES intake structure as well as the relocation of high-power electrical lines could potentially further impact cultural resources within the project area. There is a high potential for additional archaeological sites to exist within the unsurveyed portions of the project area. All unsurveyed portions of the project area must be surveyed prior to any ground-disturbing activities. Identified resources must be evaluated for eligibility to the NRHP. Impacts to any NRHP-eligible resources would be considered significant.

In summary, five archaeological sites are currently known in the APE. Both known and unknown cultural resources may be affected by two separate construction actions, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 2; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea. The exact locations of these sites are unknown, but it is possible that such sites could be affected by the construction or dredging activities.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Model projections of this alternative indicate that by year 2015 the Sea level would decrease by 3 feet to –230 feet msl. Exposure of presently submerged cultural resources could have both beneficial and significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant impacts are the same as described for Alternative 2 with current inflow conditions, but with several additional actions. Significant but mitigable effects could also result from the Displacement Dike, Pupfish Pond, Flood Flows, and the North Wetland Habitat.

Impacts for the Pupfish Pond would be the same as discussed for Alternative 1 with current inflow conditions. Impacts for the Displacement Dike and North Shorebird Pond would be the same as for Alternative 1 with reduced inflow conditions to 1.06 maf/yr.

Significant but mitigable impacts on cultural resources could also result from Import Flood Flows. This is due to the potential for flood or erosion damage to cultural resources located near the Salton Sea, as well along the lengths of the Alamo River and Salt Creek.

In summary, eight archaeological sites are currently known within the APE of this alternative. Both known and unknown cultural resources may be affected by seven separate construction actions, flood flows, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 2; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea. The exact locations of these sites are unknown, but it is possible that such sites could be affected by the construction or dredging activities.

4.16.7 Alternative 3

Significant but mitigable impacts to archaeological, architectural, and ethnographic may occur from Alternative 3.

Effect of Alternative 3 with Current Inflow Conditions

Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 2 feet to –229 feet msl. Exposure of presently submerged cultural resources could have both beneficial and negative significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant but mitigable impacts would occur if construction or other activities associated with the EES at the Test Base disturb cultural resources. A total of 172 archaeological sites are known for this area, yet only 32.6% of the area has been surveyed for cultural resources. Ninety-one of the 172 sites have been determined potentially eligible for listing of the NRHP. Construction of the EES intake structure extending into the Salton Sea could also impact submerged cultural resources within the project area.

In summary, 172 archaeological sites are currently known for the APE of this alternative. Both known and unknown cultural resources may be affected by two separate construction actions, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 3; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea. The exact locations of these sites are unknown, but it is possible that such sites could be affected by the construction or dredging activities. The Torres Martinez have also expressed concern over cultural resources located on the U.S. Navy Test Base that may be affected by the EES. Although not considered TCPs or TUAs, the Torres Martinez consider these to be sensitive sites that require preservation.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 3 feet to –230 feet msl. Exposure of presently submerged cultural resources could have both beneficial and significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant but mitigable impacts could occur with this alternative and are the same as described in Alternative 3 with a continuation of current inflow conditions but with the addition of several other actions. Significant but mitigable impacts from the

Displacement Dike, Flood Flows, Pupfish Pond, and the North Wetland Habitat are the same as described in Alternative 2 with a reduction of inflows to 1.06 maf per year.

In summary, 175 archaeological sites are currently known in the APE of this alternative. Both known and unknown cultural resources may be affected by seven separate construction actions, flood flows, and from falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. Impacts to Ethnographic Resources are the same as described for Alternative 2 with reduction of inflows to 1.06 maf per year.

4.16.8 Alternative 4

Significant but mitigable impacts to archaeological and architectural resources, and ethnographic resources may result from the implementation of Alternative 4.

Effect of Alternative 4 with Current Inflow Conditions

Archaeological and Architectural Resources. No significant change of the Sea level is expected from the implementation of this alternative. Significant but mitigable impacts would occur if construction or other activities associated with the EES at the Test Base disturb cultural resources. A total of 172 archaeological sites are known for this area, yet only 32.6% of the area has been surveyed for cultural resources. In total, 91 of the 172 sites have been determined potentially eligible for listing of the NRHP. Construction of the EES intake structure extending into the Salton Sea could further impact submerged cultural resources within the project area.

Other significant but mitigable impacts that could result from the Southwest Evaporation Pond and the Pupfish Pond would be the same as described for Alternative 1 with current inflow conditions. In summary, 172 archaeological sites are currently known for the APE of this alternative. Both known and unknown cultural resources may be affected by four separate construction actions, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 4; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea. The exact locations of these sites are unknown, but it is possible that such sites could be affected by the dredging or construction activities. The Torres Martinez have also expressed concern over cultural resources located on the U.S. Navy Test Base that may be affected by the EES. Although not considered TCPs or TUAs, the Torres Martinez consider these to be sensitive sites that require preservation.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Significant but mitigable impacts could occur as a result of this alternative. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 1 foot to –228 feet msl. Exposure of presently submerged cultural resources could have both beneficial and negative significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant but mitigable impacts could occur with this alternative and are the same as described in Alternative 4 with current inflow conditions. Significant but mitigable impacts from the Displacement Dikes and North Shorebird Pond would be the same as described for Alternative 1 with reduced inflow conditions to 1.06 maf/yr. Impacts from flood flows would be the same as described for Alternative 2 with reduced inflow conditions to 1.06 maf/yr.

In summary, 173 archaeological sites are currently known within the APE of this Alternative. Both known and unknown cultural resources may be affected by six separate construction actions, flood flows, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. Impacts are the same as described in Alternative 3 with reduction of inflows to 1.06 maf per year.

4.16.9 Alternative 5

Significant but mitigable impacts to archaeological and architectural resources and ethnographic resources may occur from construction activities, dredging, and from archaeological sites becoming exposed by changes in elevation of the Salton Sea.

Effect of Alternative 5 with Current Inflow Conditions

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 2 feet to –229 feet msl. Exposure of presently submerged cultural resources could have both beneficial and negative significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

This action would use Northwest Evaporation Pond described above, with the addition of portable blowers to spray Salton Sea water into the air within the pond. Two precontact archaeological sites, consisting of an activity locus and a temporary camp, have been recorded within the project area of the Northwest Evaporation Pond. Additional archaeological sites may be encountered if facilities for the portable blowers are to be constructed.

Other significant impacts from the Evaporation Pond EES, the North Wetland Habitat, and the Pupfish Pond are the same as described in Alternative 1 with a reduction of inflows to 1.06 maf.

In summary, two archaeological sites are currently known within the APE of this alternative. Both known and unknown cultural resources may be affected by five separate construction actions, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. No specific ethnographic resources have been identified that would be affected by Alternative 5; however, the Torres Martinez Desert Cahuilla have expressed concern over submerged village sites within the Sea. The exact locations of these sites are unknown, but it is possible that such sites could be affected by the dredging or construction activities.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Archaeological and Architectural Resources. Model projections of this alternative indicate that by the year 2015 the Sea level would decrease by 3 feet to –230 feet msl. Exposure of presently submerged cultural resources could have both beneficial and negative significant impacts. Exposed resources may become subject to vandalism or looting. Exposure of archaeological materials could also result in the proper identification, documentation, and evaluation of these resources, allowing preservation of NRHP-eligible resources.

Other significant impacts include those described for Alternative 5 with current inflow conditions, and several additional impacts from the construction of the Displacement Dike, and from Flood Flows. These individual impacts are described in Alternative 2 with reduction of inflows to 1.06 maf per year.

In summary, three archaeological sites are currently known within the APE of this alternative. Both known and unknown cultural resources may be affected by five separate construction actions, and by falling Salton Sea water levels. Large portions of the project area have not been surveyed for cultural resources.

Ethnographic Resources. Impacts are the same as described in Alternative 3 with reduction of inflows to 1.06 maf per year.

4.16.10 Cumulative Effects of Restoration with Reduced Inflows

Archaeological and Architectural Resources. Several of the projects identified for the cumulative effects analysis in the Salton Sea watershed consist of the preparation of management or planning documents. These projects do not include construction, ground-disturbing activities, or the sale or transfer of land. Therefore, these projects, when considered with the restoration alternatives, would not result in cumulative impacts to archaeological and architectural resources within the watershed.

At least half of the projects, however, may involve construction, ground disturbance, or the sale or transfer of land. All of these projects could result in the loss or destruction of archaeological or architectural resources. Projects involving construction or expansion of new facilities, such as the Mexicali Wastewater System Improvements Project, the Mesquite Regional Landfill Project, the Newmont Gold Company's expansion of the

Mesquite Gold Mine Project, the Heber Wastewater Treatment System Project, the Lewis Drain Treatment Facility Project, and the Brawley Wetlands Construction and Research Facility Projects, are the most likely to result in the loss or destruction of archaeological resources. These impacts, considered together with potential impacts from the restoration alternatives, could result in a cumulative decrease in the overall amount and density of these nonrenewable resources.

Because not all areas of potential effect have been identified for the cumulative projects, it is unknown how many resources would be affected. In addition, because not all areas of the watershed have been fully investigated, it is unknown what types of archaeological or architectural resources may be affected. It is possible that implementing all of these regional projects could result in significant but mitigable cumulative impacts to the regional resource base. Compliance with all relevant Federal, State, and local historic preservation laws and regulations should serve to lessen cumulative impacts to the regional resource base. These laws and regulations generally require that efforts be made to identify, and to the greatest extent possible, avoid or lessen impacts to significant resources. Identification efforts can be expected to include intensive inventory of the project APE, and evaluation of identified resources with respect to their potential for listing on national, state, and local registers. Avoidance of impacts to significant resources is generally the preferred option for protecting the resource, but if this is not possible, treatment/mitigation measures would be developed and implemented following consultation with the State Historic Preservation Office (SHPO), the Advisory Council on Historic Preservation (ACHP), Native American tribal groups with traditional or historic ties to the area, and other agencies and interested parties.

Ethnographic Resources. As described above for archaeological and architectural resources, several of the projects identified for the cumulative effects analysis in the Salton Sea watershed consist of the preparation of management or planning documents. These projects do not include construction, ground-disturbing activities, or the sale or transfer of land. Therefore, these projects, when considered with the restoration alternatives, would not result in cumulative impacts to ethnographic resources within the watershed.

At least half of the projects, however, may involve construction, dredging, or ground disturbance. All of these projects could result in the loss or destruction of ethnographic resources. Projects involving construction or expansion of new facilities are the most likely to result in significant impacts to ethnographic resources. These impacts, considered together with potential impacts from the restoration alternatives, could result in cumulative impacts to these resources. Ethnographic resources within the APEs of the different projects, and specific impacts to these, would have to be identified on a project-by-project basis through continued consultation with Native American tribal groups that have traditional or historical ties to the area. Avoiding ethnographic resources to the greatest extent possible is the best mitigation. When avoidance is not possible, the appropriate Native American tribal groups must be consulted to develop appropriate mitigation measures. When affected ethographic resources are also listed on or eligible for inclusion on the NRHP, mitigation measures must also be developed in consultation with SHPO and ACHP.

4.16.11 Mitigation Measures

Archaeological and Architectural Resources. Reclamation and the Authority have taken the first steps to achieve compliance with applicable federal, state, and local historic preservation laws and regulations, including Section 106 of the NHPA and Section 15064.5 of CEQA. These steps have included the Class I Cultural Resources Inventory of the Salton Sea Region (Smith et al. 1999) that was prepared as background for this project, and the efforts made to contact Native American tribal groups to identify concerns that they might have with regard to potential ethnographic resources that might be present within the project APEs. Given the complexity of the project, the fact that construction and other activities associated with implementation of any of the alternatives will be phased over many years, and that specific locations for all project facilities have not yet been determined, the best means by which to further regulatory compliance over the long term is to prepare a Programmatic Agreement (PA). The PA should be prepared among Reclamation, the Authority, SHPO, ACHP, Native American tribal groups that have indicated they would like to continue involvement with the project, other land managing agencies, and other interested parties. Potential matters that may be addressed in the PA include:

- The roles and responsibilities of the different parties to the PA;
- Contact points for all parties to the PA;
- Changes in procedures or time frames that would allow the Section 106 process to be streamlined;
- Further consultation to define procedures to be followed to identify and evaluate submerged resources;
- Project alternatives that might be categorically excluded from Section 106 consultation;
- Procedures for further consultation with Native American tribal groups to identify and evaluate ethnographic resources, and potential impacts to them;
- Preparation of a Discovery Plan detailing procedures to be followed in the event that undocumented cultural resources are found during construction; and
- Standarized treatments for specific kinds of resources, in lieu of preparation of numerous site specific Treatment Plans.

Ethnographic Resources. Appropriate measures to mitigate impacts to ethnographic resources must be determined in consultation with the applicable Native American tribe. Avoiding resources should always be considered as the first and best option. As locations are identified for specific facilities or construction areas, more detailed inventories and renewed consultation efforts with all applicable tribes will be required to mitigate potential impacts. A Programmatic Agreement will be prepared that will address procedures for the identification and evaluation of ethnographic resources potentially affected by the restoration of the Salton Sea, as well as the mitigation of adverse effects to those resources. The Treatment Plan and Discovery Plan discussed above will also address ethnographic resources.

4.16.12 Potentially Significant Unavoidable Impacts

Archaeological and Architectural Resources. Potentially significant unavoidable impacts could occur to submerged archaeological sites. Because the exact locations of these sites are unknown, methods to identify and locate these sites (as described above for Mitigation Measures) may be prohibitively expensive. Because any restoration activities that may affect the floor of the Salton Sea has the potential to affect submerged resources and mitigation may not be feasible, unavoidable impacts may occur

Ethnographic Resources. Potentially significant unavoidable impacts could occur to submerged village sites that are considered sensitive resources by the Torres Martinez Band of Cahuilla Indians. Because the exact locations of these sites are unknown, methods to identify and locate these sites may be prohibitively expensive. Therefore, any restoration activities that may affect the floor of the Salton Sea could affect a submerged resource. Additional consultation with the Torres Martinez is required to identify approaches to resolve this issue.

4.17 INDIAN TRUST ASSETS

4.17.1 Summary of Environmental Consequences

Significant but potentially mitigable impacts may occur to Indian Trust Assets (ITAs) with the No Action Alternative and Alternatives 1, 2, 3, 4, and 5.

4.17.2 Significance Criteria

Potential impacts to ITAs primarily stem from any actions that affect Indian lands or real properties in the project area. The measure of impact significance on ITAs can be determined based on the monetary value of the assets to the Indian tribe (Reclamation 1994). While this value is best determined after discussion with the applicable tribal group, the final determination of ITA status is a legal issue that can be resolved in consultation with the solicitor.

4.17.3 Assessment Methods

Impact assessments for ITAs are based on the type of asset, the monetary value of the asset, and the type and extent of disturbance to the asset or its value from the proposed project. Assessment of the significance of impacts is best determined by consulting with the appropriate Indian tribe or individual.

4.17.4 No Action Alternative

Effect of No Action with Continuation of Current Inflow Conditions

The No Action Alternative may produce significant but potentially mitigable impacts to ITAs if current inflow conditions of the Sea are maintained which cause the Sea's elevation and salinity level to rise. Examples of these impacts may include inundation of tribal lands as a result of rising water levels and stresses to environmental and cultural resources that are considered ITAs. Additional loss of Torres Martinez tribal land by inundation of the Salton Sea may result in further litigation efforts by the tribe for compensation of lost property. Torres Martinez has also expressed concern that changes is elevation and salinity may hinder their efforts to maintain existing north shoreline wetland habitat for establishment of a bird refuge (Cox 1999; Torres Martinez Tribal Council 1999b). Protection of this natural resource and its potential economic value are considered by the tribe to be an ITA issue.

Effect of No Action with Reduced Inflow Conditions (1.06 maf/yr)

If the elevation decreases substantially, as is projected for reduced inflow conditions, then exposure of land containing cultural and natural resources considered by Torres Martinez to be ITAs could have both adverse and beneficial impacts. Exposure of resources may be beneficial to Torres Martinez by opening these resources up for environmental investigations including archaeological data collection and natural resource exploitation. However, exposure also opens these resources to destructive forces such as vandalism and erosion. Additionally, Torres Martinez has expressed concern that exposed lands might be spoiled by salts, DDT, or other contaminants they believe may be contained in the soils. If this is true, Torres Martinez may seek provisions to reclaim exposed lands so that the lands may be used for purposes that suit the needs of Torres Martinez (Torres Martinez Tribal Council 1999b). The soils have not been tested for contamination. If this land were found suitable for agriculture or other purposes, exposure of the land would be a beneficial impact to the Torres Martinez. The Torres Martinez also have expressed that possible benefits could result if lower water levels prevent use of existing boat launching facilities that are not tribally owned. If public boat ramp access is lost and access is moved onto tribal lands, Torres Martinez would be able to charge boaters to launch their boats from reservation lands (Torres Martinez Tribal Council 1999a, b).

4.17.5 Alternative 1

Effect of Alternative 1 with Current Inflow Conditions

Significant but potentially mitigable impacts could occur to ITAs during the initial part of Phase 1, Alternative 1 due to gradual increases in the Sea's elevation. Any increase in elevation has the potential to inundate more tribal lands belonging to the Torres Martinez and in doing so may inundate cultural and natural resources considered by the tribe to be ITAs. A decrease in elevation, as is expected in the later part of Phase 1, may have the opposite effect by exposing currently inundated tribal lands. Such impacts would be the same as those described above for the No Action Alternative.

Both adverse and beneficial impacts to ITAs also could result from use of borrow pits or other construction activities within the boundaries of the Torres Martinez Reservation. The use of borrow pits on the Reservation would convey economic benefit to the Torres Martinez. However, these borrow pits could affect cultural resources, gold deposits, or other mineral resources on the reservation. Impacts can be mitigated by placing roads and borrow areas away from known resources and monitoring borrow pit excavation to ensure that buried resources are not inadvertently affected.

In the long run, increased water quality could increase the value of the land creating an additional positive impact on ITAs.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

Impacts to ITAs for Alternative 1 with reduced inflow conditions of 1.06 maf per year are the same as those described for Alternative 1 under current inflow conditions.

4.17.6 Alternative 2

Effect of Alternative 2 with Current Inflow Conditions

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

4.17.7 Alternative 3

Effect of Alternative 3 with Current Inflow Conditions

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

4.17.8 Alternative 4

Effect of Alternative 4 with Current Inflow Conditions

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

4.17.9 Alternative 5

Effect of Alternative 5 with Current Inflow Conditions

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Impacts to ITAs from this alternative would be the same as those described for Alternative 1 under current inflow conditions.

4.17.10 Cumulative Effects of Restoration with Reduced Inflows

Several of the projects identified for the cumulative effects analysis in the Salton Sea watershed are near the Torres Martinez Indian Reservation and may have significant impacts on the ITAs of this group. These projects include the Coachella Valley/Salton Sea Nonpoint Source Project, the Caltrans Route 86 Expressway Mitigation, and the Whitewater River Flood Control Project. Because not all project areas have been defined for the cumulative projects, the extent of affected ITAs is unknown. However, the cumulative effects of these projects are expected to be the same as those resulting in the implementation of Alternative 1 of the Salton Sea Restoration Project. Avoiding impacts to ITAs for all projects would eliminate cumulative effects or would reduce them to a level that is less than significant. If avoidance is not possible, mitigation measures determined in consultation with the appropriate Native American group(s) could reduce cumulative effects to a level that is less than significant.

4.17.11 Mitigation Measures

Appropriate measures to mitigate impacts to ITAs by Reclamation are currently developed by consulting with the affected Native American group(s) and state and federal agencies, as per Bureau of Reclamation Instruction 376.13. In some cases, compensation with money or real property can be negotiated. Reclamation policy suggests that measures must be undertaken to assure that there is no net loss to the Indian owners of an affected asset. When a specific restoration alternative has been selected, additional consultation will be conducted with the Torres Martinez and any other applicable Native American groups to identify specific Indian Trust Assets that will be affected and to develop appropriate mitigation measures. Separate mitigation measures may be required for different types of trust assets, including water quality, minerals, and cultural resources.

4.17.12 Potentially Significant Unavoidable Impacts

Potentially significant unavoidable impacts are not expected to occur. Prior to the implementation of any of the restoration alternatives, Reclamation will consult with the Torres Martinez and any other applicable Native American groups to identify trust assets that may be affected and to develop measures to avoid or mitigate adverse impacts to those assets.

4.18 PALEONTOLOGICAL RESOURCES

4.18.1 Summary of Environmental Consequences

Each alternative may result in significant but mitigable impacts if earthmoving and construction activities encounter important fossils within the underlying formations and deposits.

4.18.2 Significance Criteria

Paleontological resource significance is assessed differently by various state and federal agencies. The broadest definition of paleontological significance suggests that significant nonrenewable resources include fossils that are rare or unique regionally, diagnostically, or taxonomically (Science Applications International 1994). This definition includes vertebrate fossils, invertebrate fossils that are previously unknown within the given context, or fossils that will aid in further scientific interpretations.

The BLM considers all vertebrate and some scientifically important invertebrate fossils to be valuable and significant resources (Cunkelman 1999). In 1978, Acting Associate Director of the BLM, Grissold Petty, developed a set of criteria that have been widely used by the BLM and other agencies as a guideline for assessing significance. This memorandum suggests that a paleontological resource is significant if any of the following holds true:

- It provides important information on the evolutionary trends of organisms;
- It provides important information regarding the development of biological communities or interaction between biota; or
- It is unusual, spectacular, or is in short supply and in danger of being depleted or destroyed.

A fossil may also be considered significant if it provides data useful in determining the age(s) of a rock unit or sedimentary stratum, therefore contributing to an increased knowledge of the depositional history of a region and the timing of geologic events therein (SBCM 1999). Adverse impacts to paleontological resources would include the physical destruction or damage of fossil-bearing geological formations and resulting loss of fossil resources. Other adverse impacts could occur with increased public accessibility to known fossil-bearing localities.

4.18.3 Assessment Methods

Impact assessments for paleontological resources are based on the type of fossil or fossil-bearing formation, significance of the fossil, the type of impact, and the extent of disturbance to the fossil or fossil-bearing formation from the project.

4.18.4 No Action Alternative

No significant impacts to paleontological resources are expected because no construction or earthmoving activities would occur with the No Action Alternative.

4.18.5 Alternative 1

Effect of Alternative 1 with Current Inflow Conditions

Significant but mitigable impacts may occur if earthmoving and construction activities encounter important fossils within Lake Cahuilla Deposits.

Effect of Alternative 1 with Reduced Inflows Conditions (1.06 maf/yr)

Significant but mitigable impacts may occur if earthmoving and construction activities encounter important fossils within Lake Cahuilla Deposits. Activities associated with the construction of the North Wetland Habitat, and the Displacement Dike increase the possibility that important fossils within Lake Cahuilla Deposits would be encountered.

4.18.6 Alternative 2

Effect of Alternative 2 with Current Inflow Conditions

Significant but mitigable impacts may occur if earthmoving and construction activities associated with the EES encounter important fossils within the Borrego Formation, the Brawley Formation, Lake Cahuilla Deposits or Pliocene-Pleistocene Nonmarine Sedimentary Deposits. Five documented fossil localities are located within the project area of the Bombay Beach EES. These localities have produced important vertebrate fossil finds from the Brawley Formation. Further localities are likely to be discovered during earthmoving or construction activities.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

Significant but mitigable impacts are the same as described for the Current Inflow Conditions, but increased amounts of earthmoving and construction activities associated with the Displacement Dike and the various ponds increase the possibility that important fossils within Lake Cahuilla Deposits would be encountered.

4.18.7 Alternative 3

Effect of Alternative 3 with Current Inflow Conditions

Significant but mitigable impacts may occur if earthmoving and construction activities within the Test Base encounter important fossils within the Brawley Formation, the Borrego Formation, or the Palm Springs Formation. While no localities have been identified in the project area of this alternative, it is likely that new localities may be uncovered during ground-disturbing activities.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

Significant but mitigable impacts are the same as described for the Current Inflow Conditions, but activities associated with the construction of the Displacement Dike and various ponds increase the possibility that important fossils within Lake Cahuilla Deposits would be encountered.

4.18.8 Alternative 4

Effect of Alternative 4 with Current Inflow Conditions

Significant but mitigable impacts may occur if earthmoving and construction activities within the Test Base encounter important fossils within the Brawley Formation, the Borrego Formation, or the Palm Springs Formation. While no localities have been identified in the project area of this alternative, it is likely that new localities would be uncovered during ground-disturbing activities

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

Significant yet mitigable impacts are the same as described for the Current Inflow Conditions, but activities associated with the construction of the Displacement Dike and various ponds increase the possibility that important fossils within Lake Cahuilla Deposits would be encountered.

4.18.9 Alternative 5

Effect of Alternative 5 with Current Inflow Conditions

Significant but mitigable impacts may occur if earthmoving and construction activities within the Test Base encounter important fossils within the Brawley Formation, the Borrego Formation, or the Palm Springs Formation. While no localities have been identified in the project area of this alternative, it is likely that new localities would be uncovered during ground-disturbing activities. Significant but mitigable impacts may occur if activities associated with the construction of various ponds encounter significant fossils within Lake Cahuilla Deposits.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

Significant but mitigable impacts are the same as described for the Current Inflow Conditions but activities associated with the construction of the Displacement Dike increase the possibility that important fossils within Lake Cahuilla Deposits would be encountered.

4.18.10 Cumulative Effects

Several of the projects identified for the cumulative effects analysis in the Salton Sea watershed consist of the preparation of management or planning documents. These projects do not include construction or ground-disturbing activities. Therefore, these projects, when considered with the restoration alternatives, would not result in cumulative impacts to paleontological resources within the watershed.

Projects involving construction or expansion of new facilities, such as the Mexicali Wastewater System Improvements Project, the Mesquite Regional Landfill Project, the Newmont Gold Company's Expansion of the Mesquite Gold Mine Project, the Heber Wastewater Treatment System Project, the Lewis Drain Treatment Facility Project, and the Brawley Wetlands Construction and Research Facility projects, are the most likely projects to result in ground-disturbing activities. Paleontological resources are affected primarily via subsurface soil disturbances, which include the construction of dikes, moats, levees, evaporation ponds, canals, or road construction activities. These activities, considered with potential impacts of the Salton Sea Restoration Project, could result in a cumulative decrease in the overall amount and density of these nonrenewable resources. Because not all project areas have been defined for the cumulative projects, the extent of affected paleontological resources is unknown. It is possible that implementing all of the regional projects could result in significant but mitigable cumulative impacts to the regional paleontological resource base. Avoiding important paleontological resources, to the greatest extent possible, for all of the projects within the watershed could reduce the impact to a less than significant level. When avoidance is not possible, compliance with all relevant federal, state, and local laws pertaining to paleontological resources would be implemented.

4.18.11 Mitigation Measures

Reclamation and the Authority will comply with all applicable federal, state, and local laws, regulations, and policies pertaining to paleontological resources. When specific project activities and locations have been determined, project areas will be assessed for their potential to contain fossil-bearing strata. If fossil-bearing strata are likely to exist, a qualified paleontologist will conduct a field inspection and prepare a report of findings. The report should address the fossil-bearing potential/sensitivity of the area and make recommendations as the appropriate measures to take to mitigate impacts to significant fossils that may be present. Specific mitigation measures might include the following:

- Construction monitoring by a qualified paleontologist may be recommended for project locations within paleontologically sensitive sediments, such as within the Brawley Formation or near known fossil localities;
- If paleontological resources are encountered, monitors must have the authority to temporarily suspend or divert construction activities until such resources are recovered;
- In areas where paleontological monitors are not needed full-time during earth-moving activities, provisions may be made for the instruction of construction personnel regarding the potential for encountering paleontological resources, and procedures must be established to notify a qualified paleontologist if a fossil is encountered;
- Paleontological resources collected during monitoring activities must be appropriately processed and curated in a scientific institution such as a museum or university; and
- A final report must be generated for all monitoring activities that summarizes the results of the monitoring efforts, includes a list and description of any resources found, and outlines the context and condition of these resources. Maps of the localities and field notes must accompany any collected specimens to the scientific institution of curation.

4.18.12 Potentially Significant Unavoidable Impacts

By implementing the above mitigation measures, no potentially significant unavoidable impacts on paleontological resources are expected.

4.19 ENVIRONMENTAL JUSTICE

4.19.1 Summary of Environmental Consequences

With the No Action Alternative, potentially significant environmental justice impacts could occur to low-income populations with the loss of service-industry jobs in the project area related to a decline in recreational use of the Sea.

With Alternatives 1, 2, 3, 4, and 5, submerged village sites may be affected by dredging activities, representing a disproportionate impact on a minority population (the Torres Martinez Band of Cahuilla Indians). No other significant disproportionate adverse environmental or human health impacts to low-income or minority population communities would occur with any other alternative. With restoration of the Sea, overall impacts to all populations, including minority and low-income populations, are expected to be beneficial.

4.19.2 Significance Criteria

The significance criteria are as follows:

- Does the potentially affected community include minority or low-income populations?
- Are significantly adverse environmental or human health impacts likely to fall disproportionately on minority or low-income populations?

Consideration of environmental justice issues is a federal requirement; there is no corresponding CEQA counterpart or significance criterion.

4.19.3 Assessment Methods

Environmental impacts discussed in previous sections have been evaluated to determine their significance and area of effect. Significant environmental justice impacts would result if these significant impacts cause disproportionate adverse environmental or human health impacts to low-income or minority population communities. The location of low-income and/or minority population communities near the Salton Sea was discussed in Section 3.18.

4.19.4 No Action Alternative

Effect of No Action with Continuation of Current Inflow Conditions

With the No Action Alternative, significant socioeconomic impacts are expected as a result of declining recreational and other economic uses of the Sea. Job losses would likely be in the service industry. Therefore, there may be a disproportionate adverse impact to low-income populations.

Effect of No Action and Reduced Inflow Conditions

The effect of the No Action Alternatives with reduced inflow conditions would be the same as the No Action Alternative with current inflow conditions.

4.19.5 Alternative 1

Effect of Alternative 1 with Current Inflow Conditions

Impacts would not be significantly adverse or would be beneficial. The majority of the land required for this alternative would be in the Sea. Agricultural production in the region would not be affected. There would be some additional flooding of land within the Torres Martinez Reservation. However, this impact is not expected to be significant with mitigation. Economic impacts would be beneficial to the entire region, including low-income and minority communities.

Effect of Alternative 1 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflow conditions would be the same as for the current inflow conditions.

4.19.6 Alternative 2

Effect of Alternative 2 with Current inflow Conditions

Approximately 1,200 acres of land within Riverside County and 3,000 acres of land in Imperial County would be acquired from the BLM or private landowners for this alternative. Private land would be acquired in-fee and no significant impacts to low-income or minority populations are expected. Other impacts related to this alternative would be the same as described for Alternative 1.

Effect of Alternative 2 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflow conditions would be the same as for the current inflow conditions.

4.19.7 Alternative 3

Effect of Alternative 3 with Current inflow Conditions

Approximately 4,200 acres of land owned by the federal government would be converted for this alternative and no low-income or minority landowners would be affected. Other impacts related to this alternative would be the same as described for Alternative 1.

Effect of Alternative 3 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflow conditions would be the same as for the current inflow conditions.

4.19.8 Alternative 4

Effect of Alternative 4 with Current inflow Conditions

Impacts related to this alternative would be the same as those described for Alternative 1.

Effect of Alternative 4 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflow conditions would be the same as for the current inflow conditions.

4.19.9 Alternative 5

Effect of Alternative 5 with Current inflow Conditions

Impacts related to this alternative would be the same as those described for Alternative 1.

Effect of Alternative 5 with Reduced Inflow Conditions (1.06 maf/yr)

The effects of reduced inflow conditions would be the same as for the current inflow conditions.

4.19.10 Mitigation Measures

Mitigation measures for impacts to Native American Resources are presented in Section 4.16. Mitigation measures for the loss of Indian Trust Assets are detailed in Section 4.17.

4.19.11 Potentially Significant Unavoidable Impacts

None.

CHAPTER 5
ENVIRONMENTAL CONSEQUENCES OF PHASE 1 COMMON ACTIONS

Phase 1 common actions would be included within each of the Phase 1 alternatives, for which environmental consequences are discussed in Chapter 4. The common actions, regardless of the alternative they are combined with, contribute to achievement of project goals and objectives. These benefits are short-term without the implementation of the other actions that make up a complete alternative. Adverse effects of the common actions are typically local, short-term and/or mitigable.

The discussions in this chapter supplement the discussions of the environmental consequences of the alternatives provided in Chapter 4. Table 5-1 provides an overview of the environmental consequences of each Phase 1 common action for all environmental resources. All substantive effects of Phase 1 common actions are discussed in more detail in text. The discussions in this chapter include a brief review of the description of each action. More complete descriptions of each action can be found in Chapter 2.

5.1 FISH HARVESTING

Boat dock facilities and a processing plant would be located at one of several locations along the shore of the Salton Sea, including the former Salton Sea Test Base or on the Torres Martinez Indian Reservation. If either alternative 2 or 3 is selected, the dock could be at the site of the abandoned Navy pier, along the diked area adjacent to the former test base encampment area. The dock would be constructed to accommodate four berths, but only two berths would be used for harvesting fish; the other two berths would accommodate shoreline and nearshore cleanup operations. Fish harvesting would involve diesel-powered boats netting tilapia to remove them from the Sea. Nets and harvesting techniques would be designed to minimize incidental catch of other species. The harvest rate would be managed to maintain a healthy tilapia population.

Surface Water Resources

Fish harvesting could satisfy several objectives. Besides being a potentially profitable commercial industry, it would reduce the fish population, which is currently at a very high density (need Reference). Reducing the density could improve the survivability of the remaining stock, possibly making the remaining fish population more hardy and less vulnerable to rapid decreases in dissolved oxygen or other water quality variables. Finally, fish harvesting has been discussed as a potential means of reducing the nutrient content of the Sea. Fish processing operations could result in significant increases in water demand and could have an impact on local water systems.

A sustainable commercial harvest of tilapia has been roughly estimated to involve about 200 kilograms of fish per hectare of Sea surface area per year at current conditions (Hurlbert pers. Com. 1999). This estimate is based on tilapia harvests in other lakes with similar densities and would be equivalent to about 20,000 metric tons of fish per year for the current surface area of the Salton Sea. Thus, processing 20,000 metric tons of tilapia per year would result in the removal of only about 0.16 grams per square meter of phosphorous per year. The annual rate of phosphorous loading to the Salton Sea is estimated to be about 1.6 grams per square meter per year. Based on these assumptions, a sustainable fish harvest would remove 10 percent of the phosphorous that enters the Sea each year (Hurlbert pers. Com. 1999).

The ratio of nitrogen to phosphorous in tilapia is estimated to be in the range of about 15:1 to 20:1, which is roughly twice the ratio of nitrogen to phosphorous in the tributaries that flow into the Salton Sea (Holdren 1999). Although the harvest of tilapia might remove a higher percentage of the nitrogen loading than phosphorous, the percentage still would be small. In addition to the annual loading of these nutrients, organic material containing nitrogen and phosphorous is accumulated in bottom sediments. These sediments represent a vast potential source of nutrients that could replenish the nutrients in the water column even if nutrients were removed from the Sea at the annual tributary loading rate. Based on this analysis, fish harvesting alone would have a limited effect on reducing the nutrient levels in the Sea. In order for the harvesting of tilapia to have a more pronounced effect on nutrient levels it must be coupled with significant reductions in the nutrient input levels into the Sea. Even then, the Sea is likely to be eutrophic for many decades.

Geology and Soils

The proposed boat dock facilities and processing plant would be subject to ground shaking and acceleration effects, as described in Section 4.3, which could damage or destroy the structures. This would be a potentially significant impact to the structures if they were not built to be earthquake-resistant. However, repairs would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential significance of these impacts to a less than significant level.

In addition to ground acceleration impacts, the boat docking facilities could be exposed to seismically generated waves in the Sea. Because these structures will be built to withstand a certain amount of water turbulence, seiches are not expected to result in a significant impact to docking facilities.

The construction and operation of the processing plant near the Salton Sea shoreline would not result in significant impacts to the soils or topography. The plant will be built on relatively stable and level ground. The specific plant site would be identified in a site-specific geotechnical study prior to the plant's construction and would be sited away from steep slopes and erodible or corrosive soils that could make operations difficult and damage the plant.

Constructing boat-docking facilities for fish harvesting vessels would disturb soils and Salton Sea sediments. This would not be a significant impact. Soil and sediment disturbance would be temporary, and potential soil erosion would be minimized through standard construction-area erosion control techniques. Sediments with potentially elevated levels of metals and chemical contaminants could be disturbed during construction and dredging; however, these sediments likely would be redistributed within the Sea during dredged material discharge. These structures would be unlikely to disturb quantities of sediments in the areas of the highest observed selenium concentrations (the central portion of the Sea and near the Desert Shores Marina) (Levine Fricke 1999); therefore, the potential for remobilizing selenium into Salton Sea water for biological uptake would be low.

Air Quality

A fish harvesting program would have several associated sources of emissions—boat dock construction, boat operations, fishmeal grading and storing, processing plant construction, and processing plant operations. Although emissions associated with constructing a boat dock and associated facilities would be minor, a fish processing plant would generate more significant construction emissions. Boat operations also could have significant emissions, although exact emission quantities would depend on the size and number of hours the fishing boats operate.

Mitigation Measures. Mitigation for construction emission impacts would require developing and implementing a dust control plan for construction sites, including haul roads and construction equipment staging areas. In addition, the fish processing plant would require air quality permits from the relevant air pollution control district. As part of this process, a more detailed air quality analysis would be performed and specific equipment and operating rules would be developed to minimize air quality impacts.

Fisheries and Aquatic Ecosystems

Fish harvesting may reduce the magnitude of die-offs rather than the occurrence of die-offs by reducing density of fish and thus competition for limited habitat with oxygen within the water column during periods when much of the Sea goes anoxic due to temperature. It would also provide a healthier environment for the other species in the fishery, while also potentially improving the health of the remaining tilapia population (Costa-Pierce, personal communication 1999). There would be an adverse effect on individual tilapia because they would be targeted in the harvesting. However, the net effect on the tilapia fishery could be neutral or positive if harvesting results in smaller but healthier population. Nets will be used and sized accordingly to minimize the potential for entrainment by the endangered desert pupfish. There may be an initial reduction in prey items for scavenger-feeding bird species and diving birds, associated with the reduction of tilapia in the Sea. There also would be incidental take of corvina, bairdiella, and sargo. The significance of these losses would depend on the location and method of harvesting. A pilot project is currently under development to determine the appropriate methods to avoid these impacts. The pilot project will be subject to additional environmental review prior to implementation.

Mitigation Measures. Mitigation would include sizing the nets to reduce incidental capture of other species and other methods to manage and focus the harvest on tilapia.

Socioeconomics

Fish harvesting could help improve water quality by slightly reducing nutrient loading, with consequent reduction of eutrophication problems, which have been identified as a major cause of Sea odor and wildlife mortality. Harvesting would employ workers to collect the fish and process them for sale as fishmeal. Resulting employment would be a positive benefit to the area. Revenues from sale would partially offset the costs of this operation. If eutrophication is reduced, this action would likely result in long-term economic benefits by improving development opportunities.

Land Use and Planning

Fish harvesting activities would have a less than significant impact on land use. Although actual fish harvesting only would affect the in-Sea area, a small land area would be required for constructing a fish meal plant. The plant would be constructed on either the former Salton Sea Test Base or Torres Martinez Indian Reservation in a manner that is compatible with existing land use patterns.

Recreational Resources

Fish harvesting may reduce the likelihood of fish die-offs, which could reduce an existing significant negative impact on recreation due to the aesthetics and odor. Much of the present angling at the Sea for human consumption is focused on tilapia. This common action would be designed to balance harvesting with retaining an ample tilapia population to serve avian and angler recreation needs.

Public Health and Environmental Hazards

Harvesting fish from the Salton Sea likely would have no effects on public health. Processing the harvested fish into the end products likely would be sufficient to destroy all biological pathogens. While the fertilizer and fishmeal produced from harvested fish may contain selenium and other chemicals present in the fish, these products would not be consumed or ingested. The potential for human health effects to result from handling these end products is negligible. To ensure that the chemical concentrations in the fish are below levels of concern, the end products could be sampled prior to distribution; contaminated lots would not be released for distribution. Fish harvesters and processors with open wounds could be exposed to Vibrio bacteria while handling the fish. Use of proper protective clothing, such as gloves, during fish harvesting and processing would ensure that workers are not exposed to Vibrio bacteria. Additionally, sampling and sorting could be conducted prior to processing to remove infected fish from the processing stream.

Utilities and Public Services

The largest increase in demand for utilities for all common actions is related to the operation of the fish processing plant. Fish processing operations could result in significant increases in water demand and have an impact on local water systems. Because there are no sanitary sewer facilities near either potential site, wastewater from the fish processing plant would be disposed of in a septic system constructed in conjunction with the fish processing plant. Therefore, no local sanitary sewer systems would be affected. The waste byproducts generated by the fish processing operation may affect the capacity of solid waste disposal facilities. When the environmental assessment is completed for the Fish Harvesting Pilot Project, the potential impacts on utilities will be better understood. Demands on other public services related to constructing and operating all other common actions are anticipated to be minor and not significant.

Archaeological and Architectural Resources

After the location of the fish harvesting facility has been determined, the area of potential effect (APE) would be identified and inventoried for cultural resources. Procedures to determine the significance of identified resources, potential impacts to them, and how such impacts might be mitigated would be implemented as specified in the Programmatic Agreement (PA) among Reclamation, the Authority, the State Historic Preservation Officer (SHPO), the Advisory Council on Historic Preservation (ACHP), Native American tribal groups that have indicated they would like to continue involvement with the project, other land managing agencies, and other interested parties following consultation with the parties of the PA. The PA will address treatment of specific types of resources, as well as possible measures to identify submerged resources within project areas. These measures could include identifying and recording sites by archaeologists using diving equipment, identifying sites by examining core samples of the Sea bottom, and monitoring dredged materials. There is a high potential for archaeological resources to exist within the submerged portion of the APE.

Mitigation Measures. Measures to mitigate impacts to submerged resources and to known significant resources will be developed and implemented in accordance with procedures specified in the PA.

Native American Resources

The Torres Martinez Indians have raised concerns about submerged village sites within the Salton Sea and sensitive archaeological sites on the former Salton Sea Test Base. Therefore, any activities that may affect the Sea floor or the former test base may have an impact on Native American resources. Once definite locations are chosen for the proposed boat dock and fish meal plant for this common action, specific consultation efforts with the Torres Martinez Indians and other groups who traditionally used the

Salton Sea region would be required to assess impacts and to develop mitigation measures. Because the value of particular Native American resources is determined by the specific group to whom the resource is important, significance of impacts can be determined only through tribal consultation.

Indian Trust Assets

Implementing this action is expected to have beneficial impacts on Indian Trust Assets of the Torres Martinez Tribe. Direct benefits will result if boat dock and processing facilities are constructed on the Torres Martinez Indian Reservation. Other direct benefits include jobs related to construction and the fish harvesting industry. Indirect benefits will result from the improved environment and fishery and a resulting rise in tourism and recreational use. Significant but mitigable impacts may occur, however, if the required construction and industrial activities disturbs wetlands or mineral, cultural or other resources considered Indian Trust Assets by the Torres Martinez Tribe.

5.2 IMPROVED RECREATIONAL FACILITIES

The numerous public boat ramps around the Salton Sea will be repaired to improve safety and usability. Major boat ramp rehabilitation will involve dredging approximately 10,000 cubic yards of material within about three acres within the Sea per ramp, with a temporary surface disturbance of approximately three acres. Minor boat ramp rehabilitation will involve dredging approximately 5,000 cubic yards of material within about two acres of the Sea per ramp; temporary surface disturbance would involve approximately two acres. Boat ramp access roads also will be repaired.

Surface Water Resources

Potential adverse water quality impacts could result from increased motorized boat traffic and associated fuel use with the improvement of recreational facilities.

Geology and Soils

Improving recreational facilities would have soil and sediment disturbance impacts similar to those described for creating boat-docking facilities for fish harvesting (see Section 5.1).

Fisheries and Aquatic Ecosystems

Improving recreational facilities could encourage increased visitor use, which in turn could result in a potential increase in the take of sport fish species from the Sea. However, the take would continue to be managed by the State to maintain a healthy population.

Socioeconomics

Repairing public boat ramps and dredging to improve water access would have a slight, positive short-term effect on the local economy. This effect would be the result of employment and spending during the construction phase. Until water quality is improved, the demand for these facilities is expected to be similar to existing conditions; therefore, only negligible to minor beneficial impacts are expected within the next 10 years. The long-term effect depends on changes in Sea elevation and shoreline composition and future demand for the facilities. Assuming that the facilities would be designed to accommodate the current elevation and forecasted changes, they would retain the potential for providing long-term economic benefits. Given that the recreational use of the Sea has been declining due to deteriorating water quality, there is limited existing demand for the facilities. The future demand for the facilities would depend on the success of the project in improving water quality.

Land Use and Planning

Improving recreational facilities would have a less than significant impact on land use. Land disturbance would be temporary or would occur in previously developed areas. Indirect land use impacts could occur if improved recreational opportunities encourage further development in the surrounding area. It is assumed that any resulting land use changes would be implemented in a manner that is compatible with existing land uses and would be consistent with land use planning in the area. Therefore, these impacts would be less than significant.

Recreational Resources

Proposed activities associated with this common action are designed to improve access from boat ramps. The physical improvement of water-based recreation facilities at the Salton Sea would have a beneficial impact on recreation uses and facilities around the Sea. However, the most fundamental requirement for boating and water access facilities related to improvements and new facilities is Sea elevation control. If the elevation is not stabilized, the proposed improvements may be only temporary. Therefore, this common action would be most effective in combination with those alternatives and inflow conditions which provide the most stable water surface elevation.

Construction traffic and activities for all water recreation facilities and infrastructure improvements would result in temporary closures, detours, and the need for temporary facilities until work is completed.

Public Health and Environmental Hazards

Dredging, as part of boat ramp rehabilitation would disturb bottom sediments, resulting in the possible dispersion of hazardous substances accumulated on the Sea floor. This dispersion could increase the ambient concentration of chemical contaminants in the Sea and, through the food chain, could create potential health hazards for fish and duck consumers. To minimize these effects, sediment samples should be collected at the proposed dredging locations, and the analytical results should be evaluated to determine the potential for contaminant dispersion. If disturbance of these sediments could cause adverse health effects, then engineering controls should be designed and implemented to minimize the dispersion of the sediments.

The use of dredging equipment would increase the potential for accidental spills of petroleum products, primarily fuels and oils. The volume of any accidental spills compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

The preparation and implementation of spill prevention and spill response plans would further minimize these effects.

Improved recreational facilities may increase the use of motorized watercraft at the Sea, which would increase the amount of petroleum fuels and oils released into the Sea. The volume of these releases compared to the volume of the Sea likely would be minimal. Therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low. Developing motorized watercraft restrictions designed to reduce overall contaminant releases could minimize these effects.

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water. If these pockets are left standing long enough for vegetation to develop, they could provide breeding habitat for the encephalitis mosquito. Applying insect growth regulators to the water pockets or destroying them could minimize this effect.

Archaeological and Architectural Resources

After the locations of the recreational facilities have been determined, the APEs would be identified and inventoried for cultural resources. Procedures to determine the significance of identified resources, potential impacts to them, and how such impacts might be mitigated would be implemented as specified in the PA, following consultation with the parties of the PA. The PA will address treatment of specific types of resources, as well as possible measures to identify submerged resources within project areas. These measures could include identifying and recording sites by archaeologists using diving equipment, identifying sites by examining core samples of the Sea bottom, and monitoring dredged materials. There is a high potential for archaeological resources to exist within the submerged portion of the APE.

Mitigation Measures. Measures to mitigate impacts to submerged resources and to known significant resources will be developed and implemented in accordance with procedures specified in the PA.

Native American Resources

The Torres Martinez Indians have raised concerns about submerged village sites within the Salton Sea and sensitive archaeological sites on the former Salton Sea Test Base. Therefore, any activities that may affect the Sea floor or the former test base may have an impact on Native American resources. Prior to implementing this action, specific consultation efforts with the Torres Martinez Indians and other tribal groups who traditionally used the Salton Sea region would be required to determine impacts to Native American resources. These groups would be consulted to identify potential Native American resource on any lands to be affected by this common action, including inundated lands, construction staging areas, borrow areas, and riprap sources. Because the value of a particular Native American resource is determined by the specific group to whom the resource is important, significance of impacts to these resources can be determined only through tribal consultation.

Indian Trust Assets

Implementing this action is expected to have indirect beneficial impacts on Indian Trust Assets of the Torres Martinez Tribe due to increased tourism and development precipitated by improved recreational facilities. Construction activities also may have indirect beneficial impacts if the Torres Martinez Indians provide workforce or materials. Significant impacts may occur, however, if these facilities prevent using or developing recreational facilities on Torres Martinez tribal land, including fee-required boat launching facilities. Significant but mitigable impacts also may occur if the required construction activities disturb wetlands, mineral, cultural, or other resources considered Indian Trust Assets by the Torres Martinez Indians.

5.3 SHORELINE CLEANUP

A shoreline cleanup program would consist of removing dead fish on the water surface and on the shoreline. The in-sea cleanup operation would use a minimum of two trash skimmer barges to retrieve fish floating on the water surface. The beach cleaning equipment would involve a conveyor system that rakes the beach. Since similar facilities would be required for shoreline cleanup and fish harvesting activities, shared facilities would be constructed. In addition, an incinerator and holding bins would be constructed to support cleanup activities. Shoreline cleanup would be conducted at public access locations, including but not limited to the Salton Sea Recreational Area, Sonny Bono National Wildlife Refuge, Bombay Beach, Desert Beach, Salton Sea Beach, Mecca Beach, Desert Shores, Salton City, and the Niland Marina.

Geology and Soils

Constructing a boat pier would have the same types of impacts as those described for the boat docking facilities to be used for fish harvesting (see Section 5.1).

Raking sediments along the shoreline as part of the shoreline cleanup program would increase the susceptibility of the shoreline to wind and water erosion and could cause a minor temporary increase in local sedimentation in the Sea. This is not expected to have a significant impact because only a thin surface layer would be disturbed and these areas are already disturbed by foot traffic.

Air Quality

Skimmer barges and beach tractors would be additional emission sources in the Salton Sea Air Basin. In addition, constructing and operating an incinerator would require air quality permits from the appropriate air pollution control district.

Fisheries and Aquatic Ecosystems

Shoreline cleanup programs would have potential beneficial impacts as dead fish are cleared away. This would slightly improve water quality and would reduce nutrient input in that removing fish would prevent their turnover into a nutrient supply source because normally they would decay along or on the Sea shore.

Socioeconomics

Maintaining the Salton Sea shore has been deferred in the past, due to a lack of funding and multiple land ownership. Any employment associated with the cleanup program would have a minor beneficial effect on the local economy. Because this action contributes to reducing eutrophic conditions (as biomass and other detritus is removed), there would be a long-term indirect beneficial effect as development opportunities and property values increase. Cleanup of the shoreline would also benefit the local area by improving aesthetics and quality of life.

Recreational Resources

This common action would have positive impacts on recreation at the Sea. The potential to eliminate fish carcasses and their odors from the shore would give visitors a more aesthetically pleasing and positive experience. The schedule and frequency of activities conducted by this action could cause temporary moderate impacts to anglers within the Sea and along the shore.

Public Health and Environmental Hazards

Incinerating dead fish may produce emissions that could affect public health. Wind patterns and the emissions created by this operation should be further studied to determine the potential for public exposure. If potential risks to public health would result, measures to minimize exposure should be researched and implemented.

Archaeological and Architectural Resources

Less than five percent of the area within a quarter-mile buffer around the Salton Sea shoreline has been previously surveyed for cultural resources. Most of the studies conducted within this buffer area are more than ten years old. By California Office of Historic Preservation (COHP) standards, these previously surveyed areas would need to be resurveyed at a reconnaissance or sample level if they were to be directly affected by shoreline cleanup activities.

Seven archaeological sites known to contain cultural materials have been identified within a quarter mile of the shoreline. Two of these sites are aboriginal trail segments, three are lithic reduction areas, one is a boulder covered with petroglyphs, and one is a post-contact wagon road. There is a high potential for additional archaeological sites within the unsurveyed portions of the area of potential effect. All unsurveyed areas would be surveyed prior to any ground-disturbing activities. Identified resources would be evaluated for eligibility to the NRHP. Impacts to any NRHP-eligible resources would be considered significant but mitigable. In archaeologically sensitive areas, methods other than the rake for cleaning the beach should be considered, since the rake would pick up objects as small as one-half inch in diameter and cannot discriminate between trash and archaeological materials.

In addition to archaeological sites known to contain cultural materials, five sites consisting of water sources or geological formations have been recorded within a quarter mile of the shoreline. These sites were originally noted by H.S. Washburn of the US General Land Office during a survey of the Salton Sink in 1856. Two of them are saltwater sources, one is a freshwater source, and two are mud cones. Typically, sites of this nature would not be granted SHPO archaeological site designators unless they were known to contain cultural artifacts or to hold cultural value to the native group or groups who use them. At this stage of impact analysis, because the SHPO has designated these as archaeological sites, they are assumed to contain cultural resources or to have cultural value. Therefore, before any construction activities occur at or in the vicinity of these five locations, an archaeological field check should be conducted to determine the presence and sensitivity of cultural resources.

Native American Resources

No Native American resources have yet been identified on the Salton Sea shoreline; however, several tribal groups with historical ties to the area are being consulted, and they may identify sensitive resources, given the potential for use of the area in precontact times. Because of this potential, any disturbance at or near the shoreline may cause significant impacts to Native American resources. Identifying specific impacts is pending additional consultation with tribal groups in the area.

Indian Trust Assets

Some shoreline cleanup activities would occur on reservation lands of the Torres Martinez Tribe. The Torres Martinez Indians have expressed concerns over archaeological sites on their land that they consider to be Indian Trust Assets. Additional consultation with this group is ongoing to identify specific resources of concern that may be affected. Beneficial indirect impacts are likely to occur due to increased levels of recreational use precipitated by an improved environment.

5.4 INTEGRATED WILDLIFE DISEASE PROGRAM

While the integrated wildlife disease control program is limited in focus, it would allow restoration managers to adapt restoration solutions to future changes in ecological conditions. This program would be beneficial to the environmental resources in the Salton Sea study area. No adverse environmental impacts have been identified.

The integrated wildlife disease control program would be implemented to minimize losses from the various causes of bird mortality. It would focus on several factors, including early detection of outbreaks, timely and accurate diagnosis of the disease agents involved, appropriate response actions, and monitoring during the course of events to determine if adjustments to response actions are needed. The program would be a multi-agency effort involving the National Wildlife Health Center of the USGS, the USFWS, the Salton Sea Authority, and the CDFG. This program is expected to be beneficial to the biological resources of the area.

5.5 LONG-TERM SCIENCE PROGRAM

The long-term science program is a comprehensive life-of-the-project effort that would also allow restoration managers to adapt restoration solutions to future changes in ecological conditions. This program would be beneficial to the environmental resources in the Salton Sea study area. No adverse environmental impacts have been identified.

The long-term science program would include several components: conceptual modeling, long-term monitoring, quantitative modeling, focused investigations, technical assistance, and data management. The conceptual modeling would guide both long-term monitoring and focused studies toward goals and objectives identified for the project. Monitoring would be implemented to evaluate the success of restoration actions and to collect long-term data from which quantitative models could be validated. Quantitative modeling would be used to generate hypotheses about these processes and ecosystem functions that focused investigations then would explore. Focused investigations would fill in key information gaps, would support monitoring by identifying important measures that were not initially recognized, and would help in validating quantitative models. Technical assistance would involve time-responsive short-term needs, such as consultations, data synthesis and evaluations, and other scientific evaluations to guide management response and actions. The data management program that would facilitate integration of data among monitoring, focused investigations, modeling, and management is also an essential component of the science effort. This program is expected to be environmentally beneficial in that it would allow managers to adapt restoration actions to future ecological needs.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
Surface Water Resources					
➢ Surface Water Hydrology	No change in surface water hydrology.	No change in surface water hydrology.	No change in surface water hydrology.	No change in surface water hydrology.	No impact.
➢ Salton Sea Circulation	No changes in Sea circulation.	No changes in large-scale Sea circulation. Some minor local non-significant changes could occur in the vicinity of affected facilities.	No changes in Sea circulation.	No changes in Sea circulation.	No impact.
➢ Water Quality and Salinity	Potential beneficial long term reduction in nutrient levels. However, preliminary results of ongoing studies suggest that reduction in nutrient levels in Sea water will be negligible.	No changes to water quality or salinity.	Minor long-term beneficial impacts to water quality as a result of cleanup of decaying organic matter along shorelines.	Possible beneficial effect on water quality resulting from actions undertaken to control wildlife disease (such as waterborne pathogens).	Possible beneficial effect on water quality resulting from actions undertaken to control long-term science programs.
➢ Water Use and Management	Little or no change in agricultural or urban water use or management. However, future water management decisions may be affected by participation of fish harvesting industry stakeholders.	No change in agricultural or urban water use or management.	No change in agricultural or urban water use or management.	No change in agricultural or urban water use or management.	No impact.
Ground Water Resources					
➢ Ground Water Hydrology	No effect on ground water hydrology.	No effect on ground water hydrology.	No effect on ground water hydrology.	No effect on ground water hydrology.	No impact.
➢ Ground Water Quality	No effect on ground water quality.	No effect on ground water quality.	No effect on ground water quality.	No effect on ground water quality.	No impact.
➢ Ground Water Use and Management	No effect on ground water use and management.	No effect on ground water use and management.	No effect on ground water use and management.	No effect on ground water use and management.	No impact.
Geology and Soils					
➢ Soils and Sediments	No significant effect on soils and sediments. There would be some reworking of soils and sediments at facility sites. Standard construction practices would be used to minimize erosion.	There would be some reworking of soils and sediments at facility sites with no significant adverse effects. Standard construction practices would be used to minimize erosion.	Periodic reworking of beach materials to remove debris with some minor local cloudiness likely in Salton Sea water and increased shoreline susceptibility to wind and water erosion during beach cleaning events. There would be some reworking of soils and sediments at the boat pier with no significant adverse effects.	No impact.	These monitoring and modeling programs would not disturb geologic resources. Long-term operation and maintenance would be in place to repair any local erosion problems that may occur as a result of the Restoration Project.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions *(continued)*

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
➢ Geologic Hazards	No significant effects due to any geologic hazards. Earthquakes could damage facilities, but repairs would be made under long-term operation and maintenance program for the Salton Sea Restoration Project.	No significant effects due to any geologic hazards. Earthquakes could damage facilities, but repairs would be made under long-term operation and maintenance program for the Salton Sea Restoration Project.	No significant effects due to any geologic hazards. Earthquakes could damage the boat pier, but repairs would be made under long-term operation and maintenance program for the Salton Sea Restoration Project.	No impact.	Monitoring and modeling programs would not disturb geologic resources.
Air Quality					
➢ Air Quality Conditions	Construction emissions would be minor and temporary. Boat operations could have significant levels of emissions, depending on the size and hours of boat operations. Operating the fish processing plant would have limited emissions, but may produce odors.	Dock construction or repair, road repairs, and dredging would be a minor source of emissions. Increased boating activities would be an indirect source of additional emissions in the Salton Sea Air Basin.	Operating skimmer barges and beach tractors would be additional sources of emissions in the Air Basin.	No effect on air quality conditions.	No impact.
➢ Air Quality Planning	Fish processing plant would probably require air quality permits from relevant air pollution control district.	No effect on air quality planning.	Constructing and operating an incinerator would require air quality permits from the appropriate air pollution control district.	No effect on air quality planning.	No impact.
Noise					
➢ Noise Effects	Minor infrequent local noise from fish harvesting activities.	Minor short-term local construction noise. Increased operational vehicular noise in the vicinity recreational facilities; increased boat noise; consistent with boat noise effects on large recreational lakes.	Minor localized noise during cleanup activities.	No effects on noise.	No impact.
Fisheries and Aquatic Ecosystems					
➢ Lower Trophic Levels	Beneficial impact due to a decrease in predation.	Beneficial impact due to a decrease in predation.	Potential minor beneficial impact as a result of clearing out of dead fish. This would improve water quality and reduce nutrient input (i.e., fish removal would prevent their turnover into a nutrient supply as they decay on the Sea shore).	No impact.	No impact.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions *(continued)*

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
➢ Fish	No impact to fish populations provided methods used minimizes by-catch and harvest is monitored to ensure sustainable population levels.	Minor adverse impact due to increased take as a result of increased recreational fishing.	Potential minor beneficial impact as a result of clearing out of dead fish. This would improve water quality, and reduce nutrient input (i.e., the removal of fish would prevent their turnover into a nutrient supply as they decay on the Sea shore).	No impact.	Beneficial impacts would result from introducing programs which would most likely decrease large scale die-offs and reduce disease.
➢ Special Status Species	Potential significant adverse impact. It would depend on harvesting methodology. Nets will be sized to minimize potential entrainment by the endangered desert pupfish.	No impact. There are no proposed facilities in pupfish habitat.	Potential minor beneficial impact as a result of clearing out of dead fish. This would improve water quality, and reduce nutrient input (i.e., fish removal would prevent their turnover into a nutrient supply as they decay on the Sea shore).	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.	Beneficial impacts would result from introducing programs which would most likely decrease large scale die-offs and reduce disease.
➢ Sport Fisheries	Minor adverse impact on tilapia fishery. Beneficial impact to other species due to reduction in tilapia densities. Potential adverse impacts to sport fishery due to by-catch.	Improving recreational facilities could encourage increased visitor use, which in turn could result in a potential increase in the take of sport fish species from the Sea. However, the take would continue to be managed by the State to maintain a healthy population.	Potential beneficial impact as a result of clearing out of dead fish. This would improve water quality, and reduce nutrient input (i.e., fish removal would prevent their turnover into a nutrient supply as they decay on the Sea shore).	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.
Avian Resources					
➢ Bird Species	Potential adverse effect to those species that are opportunistic feeders (scavenger species) due to reduction in available food.	Minor to negligible effects to avian habitat, foraging, and nesting. Indirect effect of increased recreation may reduce available area for foraging. Minor effect due to loss of near shore habitat for feeding.	Potential adverse effect to those species that are opportunistic feeders (scavenger species) due to reduction in available food.	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.
➢ Special Status Species	No impact to sensitive species.	No impact to sensitive species.	No impact to sensitive species.	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.	Beneficial impacts would result from introducing programs which would most likely prevent large scale die-offs and disease reduction.
➢ Vegetation and Wildlife	Minor adverse impact to vegetation and wildlife due to construction of on shore facilities.	Minor adverse impact to vegetation and wildlife due to construction of on shore facilities.	Minor adverse impacts to vegetation and wildlife from clean-up activities.	No impact.	No impact.
➢ Plant Communities	Minor adverse impact to near-shore habitat from clean-up activities.	Minor to negligible effects due to constructing upland recreational facilities.	Minor negative impact to near-shore habitat from clean-up activities.	No impact.	No impact.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions *(continued)*

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
➢ Special Status Species	No impact.	No impact.	No impact.	No impact.	No impact.
➢ Sensitive Habitats	No impact.	No impact.	No impact.	No impact.	No impact.
➢ Sensitive Plants	No impact.	No impact.	No impact.	No impact.	No impact.
Socioeconomics					
➢ Regional Economics	Potential beneficial effect on employment at fish processing plant. If eutrophication is reduced, potential for long-term economic benefits through improved development opportunities.	Short-term beneficial effect on local economy through increased employment and spending during construction. Potential for long-term economic benefits, depending on success of restoration project.	Minor beneficial economic effects from any increase in employment. Potential long-term indirect beneficial effect from increased development opportunities and property values.	Positive employment effects to the local area. Potential net economic benefits by improving quality of fishing/boating and bird watching.	No impact.
➢ Demographics and Housing	No effects on demographics and housing.	No effects on demographics and housing.	No effects on demographics and housing.	No effects on demographics and housing.	No effects on demographics and housing.
Land Use and Planning					
➢ Urban Land Use	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.
➢ Commercial and Industrial Land Use	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.	No effects on urban land use.
➢ Public Land Use	No adverse effects on public land use.	No adverse effects on public land use.	No adverse effects on public land use.	No adverse effects on public land use.	No adverse effects on public land use.
➢ Local Land Use Plans and Policies	No conflicts with local land use plans and policies.	No conflicts with local land use plans and policies.	No conflicts with local land use plans and policies.	No conflicts with local land use plans and policies.	No conflicts with local land use plans and policies.
Agricultural Land Resources					
➢ Agricultural Land Use	No effects on agricultural land use.	No effects on agricultural land use.	No effects on agricultural land use.	No effects on agricultural land use.	No effects on agricultural land use.
➢ Agricultural Economics	Some possible benefit from use of fish in livestock food or fertilizer products.	No effects on agricultural economics.	No effects on agricultural economics.	No effects on agricultural economics.	No effects on agricultural economics.
Recreational Resources					
➢ Recreation Use	Potential impacts to sport fishing with possible removal of desirable sport fish and quantity of tilapia for consumption by local anglers. Possible benefit if courtesy dock is available on fish harvesting operations pier.	Improvements will be a positive impact if elevation is stabilized. If elevation is not stabilized, improvements will only be temporary.	Positive impact on recreation opportunities.	Potentially long-term benefits to ecotourism, public relations component with interpretation highly recommended.	Potentially long-term benefits to ecotourism, public relations component with interpretation highly recommended.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions *(continued)*

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
Aesthetics					
➢ Visual Resources	Minor changes in visual environment along shoreline associated with constructing or rehabilitating docks and constructing a fish processing plant.	Improvement of boat launch facilities expected to result in slight improvement in visual character of shoreline.	Visual quality of the shoreline should be improved by shoreline cleanup efforts.	Visual quality of the shoreline should be improved by long-term program to reduce wildlife diseases.	No impact.
➢ Odors	Operating the fish processing plant may produce odors. Long-term improvement in odors expected through reduction of biomass in the Sea.	No significant effect on odors.	Odor problems along shoreline should be improved by shoreline cleanup efforts. Operating an incinerator could be a localized source of odors.	Odor problems along shoreline should be improved by long-term program to reduce wildlife diseases.	No impact.
Public Health and Environmental Hazards					
➢ Biological Pathogens	No effect on biological pathogens.	Could increase the level of biological pathogens in the Sea and would increase the number of people exposed to pathogens present in the Sea.	No effect on biological pathogens.	No effect on biological pathogens.	Science program may lead to actions that reduce the potential health hazards from biological pathogens at the Sea.
➢ Mosquito-borne Diseases	No effect on mosquito-borne diseases.	Would increase the number of people potentially exposed to mosquito-borne diseases.	No effect on mosquito-borne diseases.	No effect on mosquito-borne diseases.	No effect on mosquito-borne diseases.
➢ Chemical Hazards	May increase releases of petroleum products from motorized watercraft used for harvesting fish.	Would likely increase the number of people consuming fish that contain selenium. Could disturb contaminants in the bottom sediment during dredging operations. May increase releases of petroleum products from motorized watercraft.	May increase releases of petroleum products from motorized vehicles used for the cleanup.	No effect on chemical hazards.	Science program may lead to actions that reduce the potential health hazards from chemical hazards the Sea.
Utilities and Public Services					
➢ Utilities (Water Service, Wastewater Service, Electricity, and Solid Waste Disposal Facilities)	Operation of the fish processing plant could result in a significant demand on local water and wastewater systems. No significant effect on all other local utilities.	Some increased demand for local utilities; not expected to result in a significant adverse effect on local utility suppliers.	No significant effect on local utilities.	No significant effect on local utilities.	No significant effect on local utilities.
➢ Public Services (Traffic, Education, Police Service, and Fire Service)	No significant effect on public services.	Local increases in traffic near recreational facilities; expected to be within the capacity of roads that operated at high traffic volumes in the past.	No significant effect on public services.	No significant effect on public services.	No impact.

Table 5-1
Summary of Potential Environmental Consequences of Phase 1 Common Actions *(continued)*

Resource	Fish Harvesting	Improved Recreational Facilities	Shoreline Cleanup	Integrated Wildlife Disease Program	Long-term Science Programs
Cultural Resources					
➢ Archaeological and Architectural Resources	Significant impacts to archaeological resources are possible if resources are disturbed during construction activities related to fish harvesting or processing facilities. Submerged archaeological resources may be affected by dredging activities.	Significant impacts to archaeological resources are possible if resources are disturbed during construction activities related to the improvement of recreational facilities. Submerged archaeological resources may be affected by dredging activities.	Significant impacts are expected due to the density of archaeological sites recorded along the shoreline. Construction activities may also create significant impacts.	No significant effects on cultural resources are expected unless ground-disturbing activities are deemed necessary at a later date.	No impact.
➢ Native American Resources	Significant impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez. Potential benefits to Torres Martinez through participation in fish harvesting programs.	Significant impacts are possible if construction disturbs submerged village sites that are considered sensitive by the Torres Martinez. Some potential benefit to Torres Martinez from increased recreational uses of the Sea.	No significant impacts to Native American resources have been identified.	No significant impacts to Native American resources are expected.	No impact.
➢ Paleontological Resources	Significant effects are not likely unless construction activities disturb paleontologically sensitive sediments.	Significant effects are not likely unless construction activities disturb paleontologically sensitive sediments.	No impacts on paleontological resources are expected.	No impacts on paleontological resources are expected.	No impact.
Indian Trust Assets					
➢ Indian Trust Assets	Some potential benefit to tribal assets through participation in fish harvesting programs. Significant but mitigable impacts may occur if construction or industrial activities disturb wetland, mineral, cultural or other resources considered Indian Trust Assets.	Some potential economic benefit to tribal assets from increased recreational uses of the Sea. Significant but mitigable impacts may occur if construction or industrial activities disturb wetland, mineral, cultural or other resources considered Indian Trust Assets.	Significant impacts may occur if activities disturb cultural resources considered Indian Trust Assets. Some potential benefit to the quality of the shoreline at the Torres Martinez Reservation is expected, as well as economic benefits from increased recreational use or the region.	Indirect benefits on the Torres Martinez due to increased recreational activities in conjunction with improved environmental conditions.	No impact.
Environmental Justice					
➢ Environmental Justice	No environmental justice issues.	No environmental justice issues.	No environmental justice issues.	No environmental justice issues.	No impact.

CHAPTER 6
ENVIRONMENTAL CONSEQUENCES OF PHASE 2 ACTIONS

Phase 2 actions would be implemented at the end of Phase 1, which is projected to occur around the year 2030. Phase 2 actions would be needed to extend the useful service life of Phase 1 actions and to provide long-term solutions to the problems at the Salton Sea. At this stage of the Salton Sea Restoration Project planning process, only preliminary conceptual designs of Phase 2 actions have been developed. More detailed designs will be developed following decisions on Phase 1 alternatives, during the Phase 1 design and construction phase, unless the No Action Alternative is selected. Because detailed designs have not yet been developed it is not possible to develop detailed evaluations of environmental consequences of Phase 2 actions. Instead, more general descriptions of the potential environmental consequences of each alternative are provided. These descriptions are intended to provide the decision-makers with an overall picture of the consequences of the total Restoration Project.

6.1 NO ACTION/NO PROJECT ALTERNATIVE

While several projects being considered near or within the Salton Sea Restoration Project study area could affect inflows to the Sea, none of these projects have yet been approved or funded. Therefore, for purposes of analysis, project effects have been evaluated against three No Action/No Project inflow scenarios:

- Current (present-day) inflow conditions continue throughout both Phases 1 and 2, with average annual inflows of 1.36 maf/yr;
- Annual inflows are incrementally reduced throughout Phase 1 to 1.06 maf/yr at the beginning of Phase 2; inflows remain at 1.06 maf/yr throughout Phase 2; and
- Annual inflows are incrementally reduced throughout Phase 1 and continue to decline into Phase 2 until they reach 0.8 maf/yr.

These potential future inflow scenarios are considered reasonable future scenarios, in light of the varied projects currently under consideration that may ultimately gain approval. In addition to different inflow scenarios, the conditions at the Sea at the beginning of Phase 2 will depend on whether Phase 1 alternatives have been implemented. Therefore, the discussions that follow are divided into two cases—without Phase 1 alternatives and with Phase 1 alternatives.

6.1.1 No Action/No Project for Phase 2 without Phase 1 Actions

If Phase 1 actions are not implemented, conditions at the Salton Sea will continue to deteriorate during Phase 2. Projected water surface elevation and salinity for each inflow condition at the beginning of Phase 2 and in the year 2060 are as follows:

	Present Day		Year 2030		Year 2060	
Final Inflow Condition	**Elevation (feet)**	**Salinity (mg/L)**	**Elevation (feet)**	**Salinity (mg/L)**	**Elevation (feet)**	**Salinity (mg/L)**
Current	-227	44,000	-224	52,896	-223	64,253
1.06 maf/year	NA	NA	-234	75,050	-241	122,530
0.8 maf/year	NA	NA	-234	75,043	-249	177,848

Notes: NA = not applicable

No Action with Continuation of Current Inflows

From the data shown above, for continuation of current inflow conditions, there would be little change in the water surface elevation of the Sea throughout the Phase 2 period. However, the salinity would increase significantly. By the beginning of Phase 2, salinity would have exceeded 50,000 mg/L and it would continue to rise to the projected value of 64,253 mg/L by the year 2060. All significant adverse environmental consequences of the No Action/No Project alternative with continuation of current conditions, as discussed for Phase 1 in Chapter 4, would continue in Phase 2. Significant adverse impacts would include loss of fish populations due to increased salinity. This reduction of food base would have serious impacts to the biodiversity of the Sea and could negatively impact population levels of fish eating birds. In addition, none of the project goals would be attained.

No Action with Reduced Inflows

For reduced inflow conditions, the changes would be much greater than for continuation of current inflow conditions. For example, if annual inflows decline to 1.06 maf/yr, the water surface elevation would drop about 14 feet from the present day and the salinity would exceed 120,000 mg/L by 2060. If annual inflows decline to 0.8 maf/yr, the water surface elevation would drop about 22 feet and the salinity would exceed 175,000 mg/L by 2060.

The environmental consequences of the No Action/No Project alternative for continuation of current conditions and inflow reductions to 1.06 maf/yr are discussed in Chapter 4. The further reduction of inflows to 0.8 maf/yr would accelerate the deterioration of the Sea. All significant adverse environmental consequences of the No Action/No Project alternative with reduced inflow conditions as discussed for Phase 1 in Chapter 4 would continue in Phase 2. Significant adverse impacts would include rapid loss of fish populations with related negative impacts to birds in the Sea and none of the project goals would be attained. In addition, the environmental impacts would be more severe or occur more rapidly if inflows are further reduced from 1.06 maf/yr to 0.8 maf/yr.

6.1.2 No Action/No Project for Phase 2 with Phase 1 Actions In-Place

If Phase 1 actions are implemented but no additional actions are taken for Phase 2, the environmental consequences would depend on the alternative and the long-term inflow condition at the Sea. The consequences of No Action during Phase 2 with Phase 1 actions in-place for each alternative are discussed below. Table 6.1-1 presents a summary of the performance of project alternatives along with the alternative for No Action during Phase 1. Table 6.1-1 illustrates expected conditions in the Sea with Phase 1 actions in-place, if Phase 2 actions are not implemented. In the case of Alternative 1, the data in Table 6.1-1 for 2030 shows the effect of constructing Phase 1 actions without the accelerated export in 2015. Figures 6.1-1 through 6.1-6 illustrate salinity and elevation over time for each of the three inflow scenarios, for each alternative with and without Phase 2 actions.

Alternative 1 or 5: No Action in Phase 2 with Phase 1 Actions In-place

Continuation of Current Inflow Conditions. If the evaporation ponds are constructed during Phase 1 as part of Alternative 1, and no additional measures are implemented during Phase 2, the ponds will have a limited life based on seismic design considerations. Likewise, a single pond constructed during Phase 1 for Alternative 5 would also have a limited life. The pond in Alternative 5 would fill-up with salts, so that it would be unusable during Phase 2. Salinity in the Sea would then rise to unacceptable levels early in Phase 2. If inflows continue at current levels, the Sea level would also rise several feet above its current level. The ponds in Alternative 1 are assumed to be unusable for salinity control after 30 years under the assumption that they have failed due to seismic events.

Reduced Inflows. If future inflows are reduced to 1.06 or 0.8 maf/yr, then the Sea elevation would begin to drop and the salinity would rapidly increase. Regardless of the inflow condition, project goals would not be achieved under No Action for Phase 2, if Phase 1 Alternative 1 is in place. Significant adverse impacts are expected.

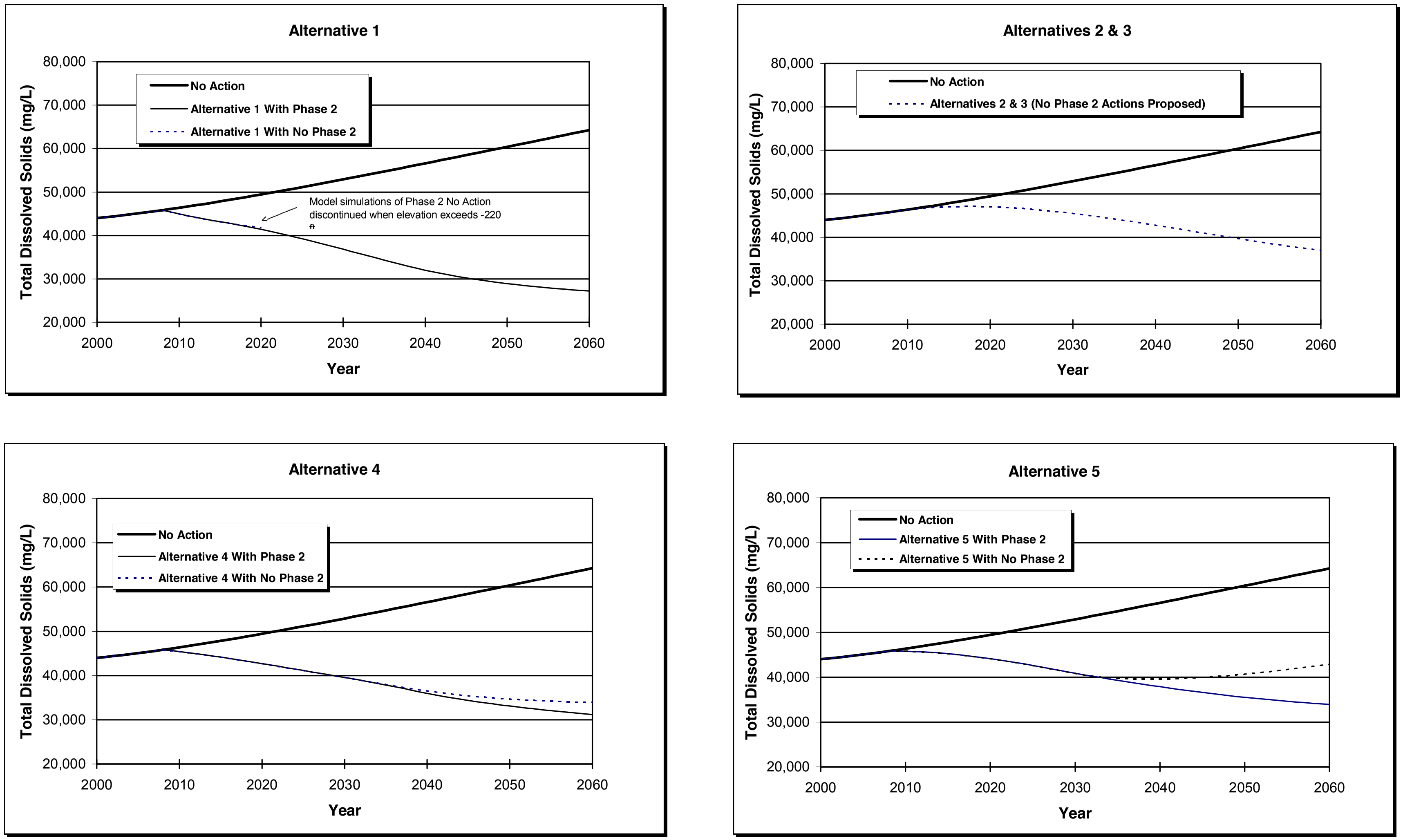

Figure 6.1-1 Comparison of Salinity at 1.36 maf/yr Inflow With and Without Phase 2 Actions

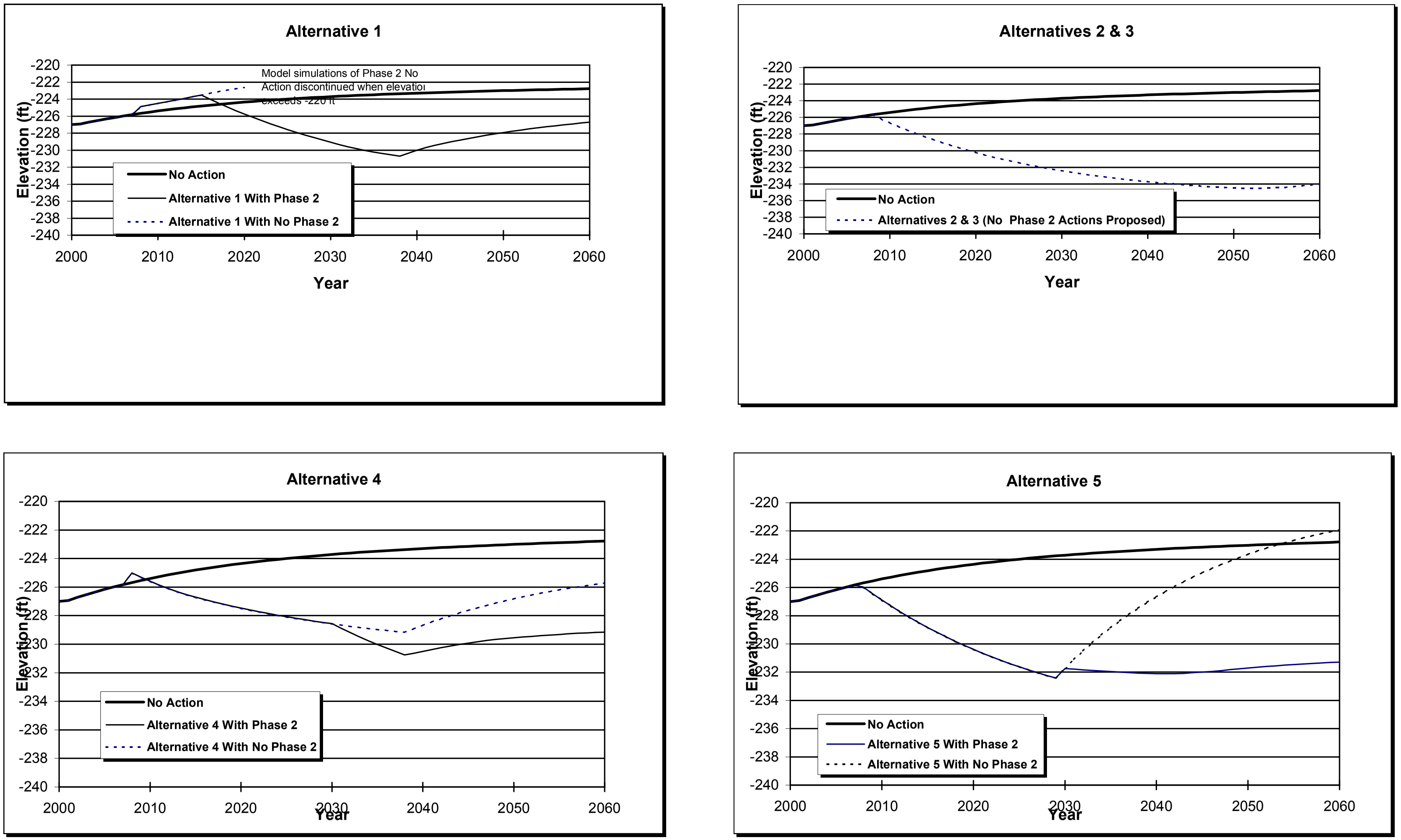

Figure 6.1-2 Comparison of Elevation at 1.36 maf/yr Inflow With and Without Phase 2 Actions

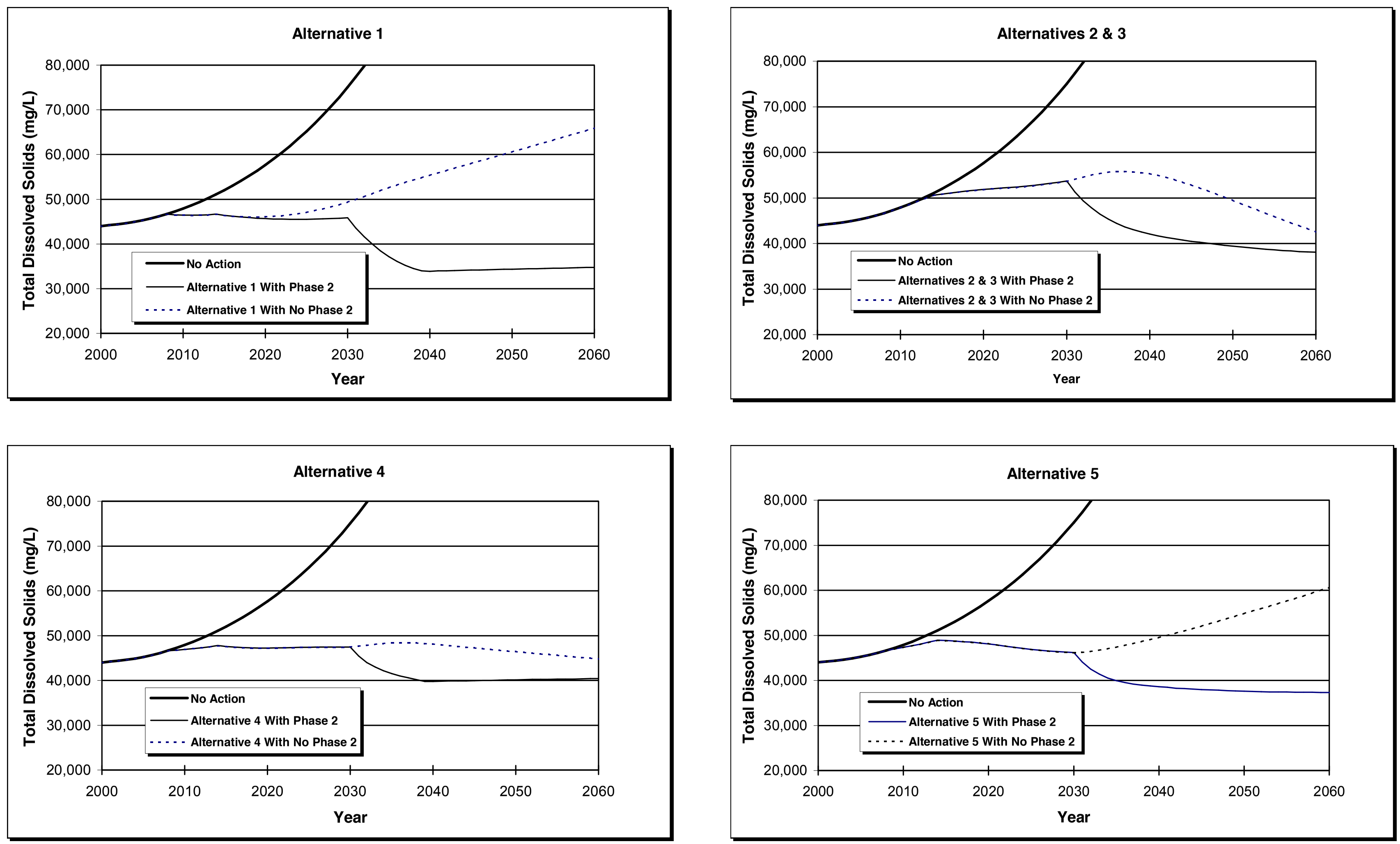

Figure 6.1-3 Comparison of Salinity at 1.06 maf/yr Inflow With and Without Phase 2 Actions

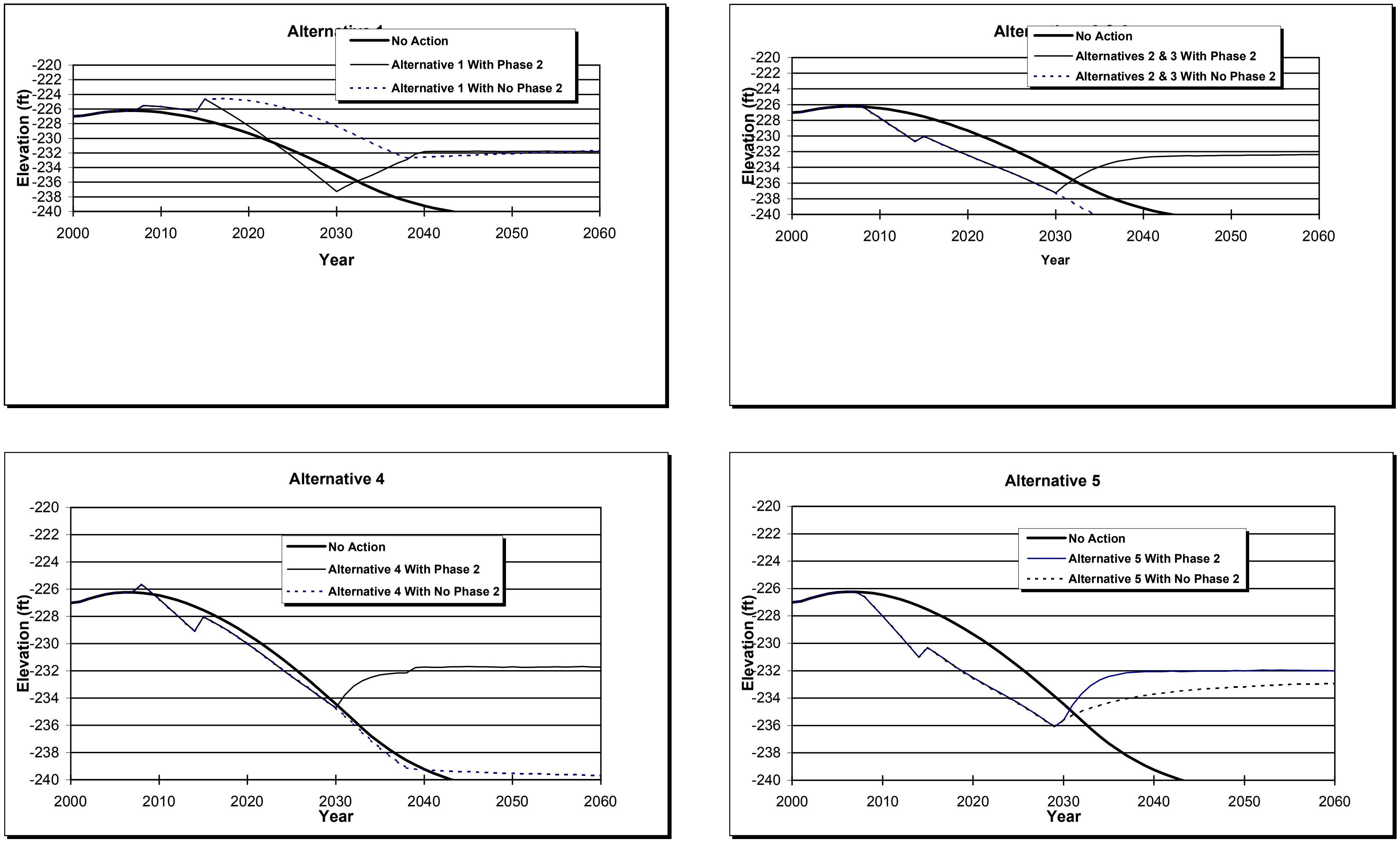

Figure 6.1-4 Comparison of Elevation at 1.06 maf/yr Inflow With and Without Phase 2 Actions

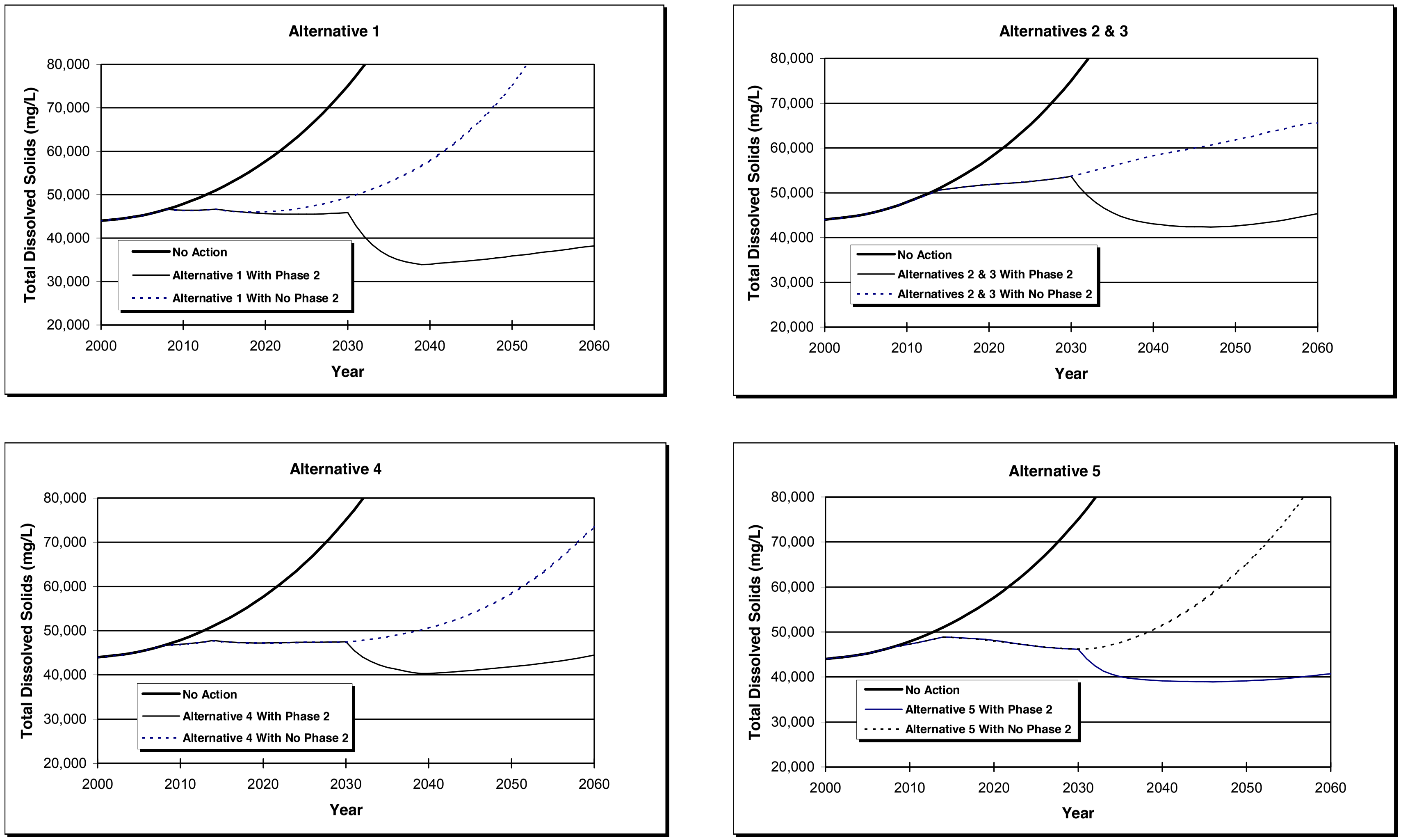

Figure 6.1-5 Comparison of Salinity at 0.80 maf/yr Inflow With and Without Phase 2 Actions

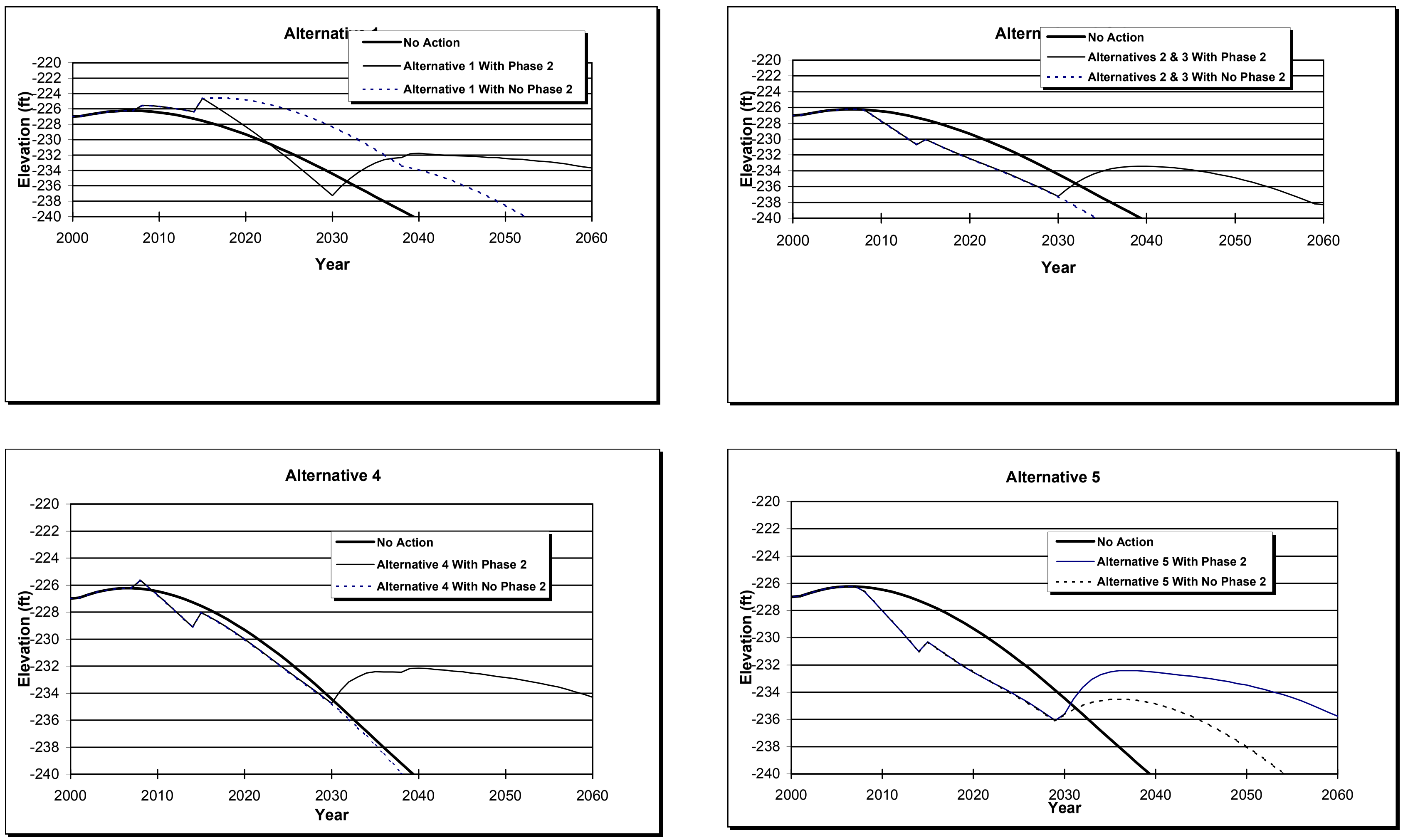

Figure 6.1-6 Comparison of Elevation at 0.80 maf/yr Inflow With and Without Phase 2 Actions

Alternative 2 or 3: No Action in Phase 2 with Phase 1 In-place

Continuation of Current Inflow Conditions. If an EES is constructed during Phase 1 as part of Alternative 2 or 3, no additional measures are proposed during Phase 2. It is possible that project goals could be met if current inflow conditions continue. This situation can be seen from the data provided in Table 6-1. From Table 6-1, if current inflow conditions continue, by 2060, the salinity could be maintained near 37,000 mg/L and elevation would be at about –234 ft, msl without additional Phase 2 actions.

Reduced Inflows. If future inflows are reduced to 1.06 or 0.8 maf/yr, then the Sea elevation would begin to drop and the salinity would rapidly increase without additional imports proposed as Phase 2 actions for reduced inflow scenarios. With either reduced inflow condition, project goals would not be achieved under No Action for Phase 2, if either Phase 1 Alternative 2 or 3 were in place. Significant adverse impacts are expected.

Alternative 4: No Action in Phase 2 with Phase 1 In-place

Continuation of Current Inflow Conditions. If an EES and the evaporation ponds are constructed during Phase 1 as part of Alternative 4, and no additional measures are implemented during Phase 2, it is not possible that project goals could be met if current inflow conditions continue. Similar to Alternative 1, the pond would be unusable during Phase 2 because of failure due to seismic events. If the EES were not expanded, then salinity in the Sea would begin to rise. The long-term adverse effects on aquatic and avian species associated with elevated salinity would be expected to occur as salinity would gradually increase during Phase 2.

Reduced Inflows. If future inflows are reduced to 1.06 or 0.8 maf/yr, then the Sea elevation would begin to drop and the salinity would rapidly increase. With either reduced inflow condition, project goals would not be achieved under No Action for Phase 2, if Phase 1 Alternative 4 is in place. Significant adverse impacts are expected.

6.2 PERFORMANCE OF PHASE 2 ALTERNATIVES FOR DIFFERENT INFLOW CONDITIONS

Table 6-1 illustrates how closely the long-term project goals could be met by each alternative during Phase 2, for each of the three inflow scenarios. As shown for the year 2060 for all restoration alternatives and all three inflow conditions, salinity could be maintained at an acceptable level for fish and wildlife, compared to No Action. Likewise, elevation could be managed much closer to the target level than under No Action.

For Alternative 1, if inflows are reduced to 0.8 MAFY, flood flows would be imported to supplement the reduced inflow. In each of the other alternatives, importation of flood flows would have already been initiated in Phase 1, when inflows were reduced to 1.06 MAFY, and would simply be continued in Phase 2. The impacts of importation of flood flows, both in the Salton Sea Basin and on the Colorado River downstream of the point of diversion at Imperial Dam, would be generally the same as previously described for Phase 1 in Section 4.1.6. The trend toward reduction in the availability of flood flows is expected to continue beyond 2040 (see Figure 4.1-7 in Chapter 4), reducing the reliability of flood flows as a means of maintaining elevation of the Salton

Sea, and potentially reducing the quantity of excess water delivered to Mexico. These effects become increasingly speculative as the planning horizon is extended into the future. As described in Chapter 4, the potential for adverse effects of occasional flood flow diversions to the Salton Sea on the Colorado River downstream of the point of diversion are likely to be small compared to the level of uncertainty of benefits from flood flows under the No Action Alternative. Also, some of the potential benefits foregone in the Colorado Delta due to the diversion of flood flows from the Colorado River would be similar in nature to the benefits obtained by use of these flood flows to meet environmental objectives at the Salton Sea. For these benefits, the diversion of flood flows to the Salton Sea does not necessarily represent a net reduction in benefits, but rather a change in the location of the benefits, and perhaps a net increase in benefits due to more effective use of the water.

6.3 PHASE 2 EXPORT ALTERNATIVES

An overview of the environmental consequences of Phase 2 export actions for all environmental resources is provided in Table 6.3-1. The following discussions in this section include a brief review of the description of each alternative. Expanded descriptions of each of the actions can be found in Chapter 2.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
Surface Water Resources					
➢ Surface Water Hydrology	Impacts would be the same as those described for the EES in chapter4.	Discharging Salton Sea water into the Gulf of California could potentially result in a significant impact on the receiving water. Discharges from Salton Sea combined with other discharges, flow reductions, and water conservation efforts may cumulatively increase salinity impacts on Upper Gulf of California.	Discharging Salton Sea water into the Pacific could potentially result in a significant impact on the receiving water. Discharge of Salton Sea water into the Pacific Ocean combined with the existing point and non-point sources along the coast could have less than significant cumulative impact due to dilution of salts and nutrients in the ocean.	Discharging Salton Sea water into Palen Lake could potentially result in a significant impact on the receiving area.	No significant impact. Import of CASI water to Salton Sea would have a beneficial cumulative impact on the salinity of the Gulf of California.
➢ Salton Sea Circulation	No significant impact.	No significant impact.	No significant impact.	No significant impact.	No significant impact.
➢ Water Quality and Salinity	Beneficial impact to water quality and salinity in the Sea	Beneficial impact to water quality and salinity in the Sea	Beneficial impact to water quality and salinity in the Sea	Beneficial impact to water quality and salinity in the Sea	Beneficial impact to salinity in the Sea. Importing CASI water has the potential adverse impact of contributing trace elements to the Salton Sea.
➢ Water Use and Management	Impacts would be the same as those described for the EES in chapter4.	No significant impact.	No significant impact.	No significant impact.	No significant impact.
Ground Water Resources					
➢ Ground Water Hydrology	No significant impact.	No significant impact.	No significant impact.	No significant impact.	No significant impact.
➢ Ground Water Quality	No significant impact.	No significant impact.	No significant impact.	No significant impact.	No significant impact.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
➢ Ground Water Use and Management	No significant impact.	No significant impact.	No significant impact.	No significant impact.	No significant impact
Geology and Soils					
➢ Soils and Sediments	The proposed Bombay Beach EES site may be subject to both wind and stream erosion. Construction and post-construction erosion-control measures would be developed to minimize this impact to a less than significant level.	Soil disturbance during pipeline construction would result in the increased potential for soil erosion. This impact would not be significant with the implementation of construction and post-construction erosion-control measures.	Soil disturbance during pipeline construction would result in the increased potential for soil erosion. This impact would not be significant with the implementation of construction and post-construction erosion-control measures.	Soil disturbance during pipeline construction would result in the increased potential for soil erosion. This impact would not be significant with the implementation of construction and post-construction erosion-control measures.	Soil disturbance during canal construction would result in the increased potential for soil erosion. This impact would not be significant with the implementation of construction and post-construction erosion-control measures.
➢ Geologic Hazards	Geologic hazards could damage the structures associated with the expanded EES. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.	Geologic hazards could cause structural damage to the pipeline. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.	Geologic hazards could cause structural damage to the pipeline. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.	Geologic hazards could cause structural damage to the pipeline. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.	Geologic hazards could cause structural damage to the canal. Repairs to damaged structures would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level.
Air Quality					
➢ Air Quality Conditions	Construction activities would have potentially significant emissions. Operating the expanded EES system would result in significant impacts associated with drifting salt spray downwind of the site.	Construction activities would have potentially significant emissions.	Construction activities would have potentially significant emissions.	Construction activities would have potentially significant emissions.	Construction activities might have minor impacts, which could be controlled with standard construction practices.
➢ Air Quality Planning	Operating expanded EES modules and associated equipment would require air quality permits from relevant air pollution control district.	Operating pumping plants probably would require air quality permits from Imperial County Air Pollution Control District.	Operating pumping plants probably would require air quality permits from San Diego Air Pollution Control District.	Operating pumping plants probably would require air quality permits from relevant air pollution control district.	Operating pumping plants probably would require air quality permits from relevant air pollution control district.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
Noise					
➢ Noise Effects	Minor short-term local construction noise. Increased operational vehicular noise but not significant.	Minor short-term local construction noise. Potential sensitive receptors along pipeline route could be temporarily affected.	Minor short-term local construction noise. Potential sensitive receptors along pipeline route could be temporarily affected.	Minor short-term local construction noise. Potential sensitive receptors along pipeline route could be temporarily affected. Impacts would be less than those anticipated for export to the Gulf of California or the Pacific.	Minor short-term local construction noise would be controlled with standard practices. No operational noise impacts are expected.
Fisheries and Aquatic Ecosystems					
➢ Lower Trophic Levels	Beneficial effects from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	Potential adverse impacts to resident species in the Gulf of California due to further degradation of water quality problems. Potential export of "exotic species".	Potential adverse impacts to resident species due to further degradation of water quality problems. Potential export of "exotic species".	No impacts because this is a dry lake.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Fish	Beneficial effects from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	Potential adverse impacts to resident species in the Gulf of California due to further degradation of water quality problems. Potential export of "exotic species".	Potential adverse impacts to resident species due to further degradation of water quality problems. Potential export of "exotic species".	No impacts to fisheries because this is a dry lake. Potential export of "exotic species".	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Special Status Species	Beneficial effects from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	Potential adverse impacts to resident species in the Gulf of California due to further degradation of water quality problems and exotic species export.	Potential adverse impacts to resident species due to further degradation of water quality problems and exotic species export.	No impacts to special status species because this is a dry lake.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Sport Fisheries	Beneficial from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	Potential adverse impacts to resident species in the Gulf of California due to further degradation of water quality problems and exotic species export.	Potential adverse impacts to resident species due to further degradation of water quality problems and exotic species export.	No impacts to sport fisheries because this is a dry lake.	Beneficial effects due to stabilization of shoreline and reduced salinity.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
Avian Resources					
➢ Bird Species	Beneficial effects from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	No impact.	No impact.	Potential significant impact resulting from possible occurrence of an outbreak of avian botulism.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Special Status Species	Beneficial effects from improved water quality conditions in the Sea. Salinity levels would be reduced to acceptable levels.	No impact.	No impact.	Potential adverse impact due to possibility of flooding at Palen Lake.	Beneficial effects due to stabilization of shoreline and reduced salinity.
Vegetation and Wildlife					
➢ Plant Communities	Potential significant adverse impact due to loss of habitat from constructing EES facilities. Also adverse impacts to surrounding vegetation due to salt spray blowing from the EES.	Adverse impact due to loss of habitat from constructing export facilities.	Adverse impact due to loss of habitat from constructing export facilities.	Adverse impact due to loss of habitat from constructing export facilities and from flooding.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Special Status Species	No impact.	No impact, assuming that the pipeline is constructed so as not to affect special status species along the corridor.	No impact, assuming that the pipeline is constructed so as not to affect special status species along the corridor.	Adverse impact due to loss of habitat from constructing export facilities and from flooding.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Sensitive Habitats	No impact.	No impact, assuming that the pipeline is constructed so as not to affect special status species along the corridor.	No impact, assuming that the pipeline is constructed so as not to affect special status species along the corridor.	Adverse impact due to loss of habitat from constructing export facilities and from flooding.	Beneficial effects due to stabilization of shoreline and reduced salinity.
➢ Sensitive Plants	No impact.	No impact, assuming that the pipeline is constructed so as not to affect special status species or sensitive habitats along the corridor.	No impact, assuming that the pipeline is constructed so as not to affect special status species or sensitive habitats along the corridor.	Adverse impact due to loss of habitat from constructing export facilities and from flooding.	Beneficial effects due to stabilization of shoreline and reduced salinity.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
Socioeconomics					
➢ Regional Economics					
Construction (Duration varies)	Positive, depending on proportions of workers employed and materials purchased from the local area.	Positive, depending on proportions of workers employed and materials purchased from the local area.	Positive, depending on proportions of workers employed and materials purchased from the local area.	Positive, depending on proportions of workers employed and materials purchased from the local area.	Positive, depending on proportions of workers employed and materials purchased from the local area.
Post-construction / Operation	Positive direct impacts, from permanent employment for operation and maintenance. Positive indirect impacts, from increased recreational use and commercial development.	Positive direct impacts, from permanent employment for operation and maintenance. Positive indirect impacts, from increased recreational use and commercial development.	Positive direct impacts, from permanent employment for operation and maintenance. Positive indirect impacts, from increased recreational use and commercial development.	Positive direct impacts, from permanent employment for operation and maintenance. Positive indirect impacts, from increased recreational use and commercial development.	Positive direct impacts, from permanent employment for operation and maintenance. Positive indirect impacts, from increased recreational use and commercial development.
Total Project Cost / Benefit	Unknown; primary benefit is to shorten time to reach target salinity level which could foster regional development and long-term economic benefits.	Unknown; primary benefit is to reduce salinity.	Unknown; primary benefit is to reduce salinity.	Unknown; primary benefit is to reduce salinity.	Unknown; primary benefit is to reduce salinity and maintain Sea elevation.
Total cost of project	$91 million per module.	$0.7 to $1.2 billion, depending on quantity transported.	$0.7 to $1.2 billion, depending on quantity transported.	$0.7 to $1.2 billion, depending on quantity transported.	Costs cannot be estimated at this time.
➢ Public Finance					
Construction	Neutral; revenues from sales and transient occupancy taxes likely to be offset by increased service costs. Long-term benefit from property tax revenues on new developments.	Neutral; revenues from sales and transient occupancy taxes likely to be offset by increased service costs. Long-term benefit from property tax revenues on new developments. Effects would be distributed across communities along the canal route.	Neutral; revenues from sales and transient occupancy taxes likely to be offset by increased service costs. Long-term benefit from property tax revenues on new developments. Effects would be distributed across communities along the canal route.	Neutral; revenues from sales and transient occupancy taxes likely to be offset by increased service costs. Long-term benefit from property tax revenues on new developments. Effects would be distributed across communities along the canal route.	Neutral; revenues from sales and transient occupancy taxes likely to be offset by increased service costs. Long-term benefit from property tax revenues on new developments. Effects would be distributed across communities along the canal route.
Post-construction / Operation	Negligible, possible benefits from property tax revenues. Revenues would likely be used to support increased demand for social services.	Negligible, possible benefits from property tax revenues. Revenues would likely be used to support increased demand for social services.	Negligible, possible benefits from property tax revenues. Revenues would likely be used to support increased demand for social services.	Negligible, possible benefits from property tax revenues. Revenues would likely be used to support increased demand for social services.	Negligible, possible benefits from property tax revenues. Revenues would likely be used to support increased demand for social services.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
➢ Demographics and Housing					
Construction	Slightly negative short-term impact, due to housing need of construction workforce.	Slightly negative short-term impact, due to housing need of construction workforce. Impact spread out over larger area during construction of canal.	Slightly negative short-term impact, due to housing need of construction workforce. Impact spread out over larger area during construction of canal.	Slightly negative short-term impact, due to housing need of construction workforce. Impact spread out over larger area during construction of canal.	Slightly negative short-term impact, due to housing need of construction workforce. Impact spread out over larger area during construction of canal.
Post-construction / Operation	May result in increased demand for permanent housing by new employees in recreation and visitor industries and for seasonal housing	Negligible minor increase in local housing demand.	Negligible minor increase in local housing demand.	Slightly negative short-term impact, due to housing need of construction workforce. Impact spread out over larger area during construction of canal.	Negligible minor increase in local housing demand.
Land Use and Planning					
➢ Urban Land Use	No significant impact, assuming that land use plans are modified under Phase I to account for expansion under Phase II. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Export to the Pacific Ocean may significantly contribute to cumulative land use impacts because of its route through heavily developed areas near the Ocean.	No impact Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.
➢ Commercial and Industrial Land Use	No impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Export to the Pacific Ocean may significantly contribute to cumulative land use impacts because of its route through heavily developed areas near the Ocean.	No significant impact Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.
➢ Public Land Use	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.	No significant impact. Contribution to cumulative land use impacts will be small unless significant development begins to occur in the affected areas.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
➢ Local Land Use Plans and Policies	May be incompatible with local land use plans.	May be incompatible with land use plans for affected jurisdictions.	May be incompatible with land use plans for affected jurisdictions.	May be incompatible with land use plans for affected jurisdictions	May be incompatible with land use plans for affected jurisdictions
Agricultural Land Resources					
➢ Agricultural Land Use	No impact. Phase 2 actions are not likely to significantly affect agriculturally important farmland and contribute to a cumulative impact.	No significant impact, assuming that the pipeline is constructed to avoid agriculturally important farmland. Phase 2 actions are not likely to significantly affect agriculturally important farmland and contribute to a cumulative impact.	No significant impact, assuming that the pipeline is constructed to avoid agriculturally important farmland. Phase 2 actions are not likely to significantly affect agriculturally important farmland and contribute to a cumulative impact.	No impact Phase 2 actions are not likely to significantly affect agriculturally important farmland and contribute to a cumulative impact.	No significant impact, assuming that the pipeline is constructed to avoid agriculturally important farmland. Phase 2 actions are not likely to significantly affect agriculturally important farmland and contribute to a cumulative impact.
➢ Agricultural Economics	No impact. Phase 2 actions are not likely to significantly affect agricultural productivity and contribute to a cumulative impact.	No significant impact. Phase 2 actions are not likely to significantly affect agricultural productivity and contribute to a cumulative impact.	No significant impact. Phase 2 actions are not likely to significantly affect agricultural productivity and contribute to a cumulative impact.	No impact Phase 2 actions are not likely to significantly affect agricultural productivity and contribute to a cumulative impact.	No impact. Phase 2 actions are not likely to significantly affect agricultural productivity and contribute to a cumulative impact.
Recreational Resources					
➢ Local and Regional Recreation	No significant effects on recreation.	Potential significant effects to recreation at Gulf of California discharge area. Potential beneficial effect to recreation at the Sea. May have potential significant impacts on recreation uses along the proposed pipeline route.	Recreation impact at point of discharge in Pacific not significant. Potential beneficial effect to recreation at the Sea. May have potential significant impacts on recreation uses along the proposed pipeline route.	Potential significant impact to off-road vehicle use in vicinity of Lake Palen. Potential beneficial effect to recreation at the Sea. May have potential significant impacts on recreation uses along the proposed pipeline route.	Beneficial impact on recreation users and facilities to the extent that the import of CASI water contributes to the improvement of salinity levels and stabilization of the Sea elevation.
Aesthetics					
➢ Visual Resources	Massing, bulk, and colors of expanded EES facility would result in moderate to strong visual contrasts with the existing desert landscape. This would be a significant and unmitigable visual effect.	Depending on their location, proposed pumping stations could have significant adverse visual effects.	Depending on their location, proposed pumping stations could have significant adverse visual effects.	Depending on their location, proposed pumping stations could have significant adverse visual effects.	Construction may cause short term impacts.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
➢ Odors	Beneficial odor effects would occur if reduced salinity improved the condition of the Sea, resulting in fewer algal blooms, fish kills, and avian kills.	Same as for Expanded EES.	Same as for Expanded EES.	Same as for Expanded EES.	Odors may improve through improved water quality
Public Health and Environmental Hazards					
➢ Biological Pathogens	The improved condition of the Sea may support greater concentrations of biological pathogens.	The improved condition of the Sea may support greater concentrations of biological pathogens.	The improved condition of the Sea may support greater concentrations of biological pathogens.	The improved condition of the Sea may support greater concentrations of biological pathogens.	The improved condition of the Sea may support greater concentrations of biological pathogens.
➢ Mosquito-borne Diseases	Construction may create water-filled depressions that could become encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans. The declining Sea level may reduce the amount of brackish marsh, which is encephalitis mosquito breeding habitat, leading to a reduction in the potential for transmission of mosquito-borne diseases to humans. Cumulative wetland development may increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans.	The declining Sea level may reduce the amount of brackish marsh, which is encephalitis mosquito breeding habitat, leading to a reduction in the potential for transmission of mosquito-borne diseases to humans. Cumulative wetland development may increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans.	The declining Sea level may reduce the amount of brackish marsh, which is encephalitis mosquito breeding habitat, leading to a reduction in the potential for transmission of mosquito-borne diseases to humans. Cumulative wetland development may increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans.	The declining Sea level may reduce the amount of brackish marsh, which is encephalitis mosquito breeding habitat, leading to a reduction in the potential for transmission of mosquito-borne diseases to humans. Cumulative wetland development may increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans.	No effects on mosquito-borne diseases. Cumulative wetland development may increase encephalitis mosquito breeding habitat, increasing the potential for transmission of mosquito-borne diseases to humans.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
➢ Chemical Hazards	Construction would increase the potential for accidental spills of petroleum products. Pumping Sea water likely would remove negligible amounts of selenium from the food chain. Wind erosion of exposed sediments and EES precipitants could result in airborne exposure to selenium and other Sea water constituents. Improved conditions at the Sea may attract more motorized watercraft users, increasing the potential for releases of petroleum products. Operation of the EES at Bombay Beach may expose visitors to airborne concentrations of salts and selenium; operation of the EES at the Salton Sea Test Base likely would not result in public exposure, due to the system's distance from populated areas.	If Mexico has no comprehensive waste management regulations, exporting Salton Sea water would be considered a nonmitigable significant adverse impact. Increased concentrations of chemicals in the Golfo de Santa Clara would be negligible and likely would not result in public health hazards. Pumping Sea water likely would remove negligible amounts of selenium from the food chain. Improved conditions at the Sea may attract more motorized watercraft users, increasing the potential for releases of petroleum products.	Increased concentrations of chemicals in the Pacific Ocean would be negligible and likely would not result in public health hazards. Pumping Sea water likely would remove negligible amounts of selenium from the food chain. Improved conditions at the Sea may attract more motorized watercraft users, increasing the potential for releases of petroleum products.	Exposed salts, selenium, and other constituents around the perimeter of the lake could result from evaporation. These materials could be subject to wind erosion; however, due to the lake's distance from populated areas, there would be no public exposure. High salinity and chemical concentrations in the Palen Dry Lakebed would not affect public health because access would be restricted. Pumping Sea water likely would remove negligible amounts of selenium from the food chain. Improved conditions at the Sea may attract more motorized watercraft users, increasing the potential for releases of petroleum products.	Because the chemical composition of the imported water is not known, it cannot be predicted whether this water would increase or decrease the presence of chemicals in the Sea.
Utilities and Public Services					
➢ Utilities (Water Service, Wastewater Service, Electricity, and Solid Waste Disposal Facilities)	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.
➢ Public Services (Traffic, Education, Police Service, and Fire Service)	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.	No significant impacts are anticipated.

Table 6.3-1
Summary of Potential Environmental Consequences of Phase 2 Export Alternatives *(continued)*

Resource	EES	Export to Gulf of California	Export to Pacific	Export to Palen	Import from Yuma
Cultural Resources					
➢ Archaeological and Architectural Resources	Potential significant impact on resources eligible for the NRHP. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on resources eligible for the NRHP. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on resources eligible for the NRHP. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on resources eligible for the NRHP. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on resources eligible for the NRHP. Combination with other proposed and ongoing projects may cause significant cumulative impacts.
➢ Native American Resources	Potential significant impact on ethnographic resources such as traditional cultural properties and traditional use areas. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on ethnographic resources such as traditional cultural properties and traditional use areas. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on ethnographic resources such as traditional cultural properties and traditional use areas. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on ethnographic resources such as traditional cultural properties and traditional use areas. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on ethnographic resources such as traditional cultural properties and traditional use areas. Combination with other proposed and ongoing projects may cause significant cumulative impacts.
➢ Paleontological Resources	Potential adverse impacts on significant paleontological resources. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential adverse impacts on significant paleontological resources. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential adverse impacts on significant paleontological resources. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential adverse impacts on significant paleontological resources. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential adverse impacts on significant paleontological resources. Combination with other proposed and ongoing projects may cause significant cumulative impacts.
Indian Trust Assets					
➢ Indian Trust Assets	Potential significant impact on Indian Trust Assets. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on Indian Trust Assets. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on Indian Trust Assets. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on Indian Trust Assets. Combination with other proposed and ongoing projects may cause significant cumulative impacts.	Potential significant impact on Indian Trust Assets. Combination with other proposed and ongoing projects may cause significant cumulative impacts.
Environmental Justice					
➢ Environmental Justice	No environmental justice issues are anticipated.	No environmental justice issues are anticipated.	No environmental justice issues are anticipated.		No environmental justice issues are anticipated.

6.3.1 Enhanced Evaporation System (EES)

A 150,000 af/yr capacity EES could be constructed as an export facility for either Alternative 1 or 5. This facility would be similar to the EES proposed for either Alternative 2 or 3. In addition, the 100,000 af/yr capacity considered for Phase 1 for Alternative 4 could be expanded to 150,000 af/yr capacity during Phase 2. In this case, the larger EES facility would be an expansion of the EES facility constructed during Phase 1. The area necessary for constructing the expanded system is contained within the original land areas designated for the Phase 1 EES. Pipelines and intakes constructed during Phase 1 would be sufficient to carry the additional flows necessary to operate the expanded system under this alternative. It is expected that constructing and operating the expanded EES facility would affect the environmental resources discussed below.

Surface Water Resources

Impacts of constructing an EES during Phase 2 for either Alternative 1 or 5 would be the same as those described in chapter 4, for a Phase 1 EES for Alternatives 2 and 3. For Alternative 1, with an expanded EES during Phase 2, the potential for release of brine from the collection and evaporation ponds would be increased, and the magnitude of a release in the event of an earthquake would be greater than with the smaller capacity system. The expanded EES would increase the number of treatment modules, and the volume of brine stored in the system. The maximum volume of liquid brine that could be released would be constant throughout the operational life of the system. A release is unlikely to result in a significant impact on water quality in the Salton Sea. The brine would be released over a large land area and would evaporate or seep into the ground before much of it could enter the Salton Sea. Perhaps the most significant effect would occur if some of the brine entered San Felipe Creek, since there it would quickly make the water in the creek change from fresh or brackish to hypersaline.

Ground Water Resources

The impacts would be of the same types described in Section 4.2, and are not expected to significantly increase the impacts already described.

Geology and Soils

Both the Calipatria Fault and the Coachella Branch of the San Andreas Fault extend through the Bombay Beach area. No known fault structures extend through the Test Base EES site. Seismic activity along these or other nearby faults could damage the system of interconnected towers that make up the EES, cause structural damage to the catchment basin, and rupture the intake pipe for the system. Repairs to structural damage would be made under the long-term operation and maintenance program for the Salton Sea Restoration Project, reducing the potential for these impacts to a less than significant level. The proposed Bombay Beach EES site may be subject to both wind and stream erosion. Construction and post-construction erosion-control measures would be developed to protect the soils surrounding the towers and catchment basin. These measures would minimize this impact to a less than significant level. Potentially corrosive soils could damage the intake pipe. Soils along the Sea margin are highly saline, and salt resistant construction materials would be used to construct any subsurface structures in this area.

Air Quality

An EES facility would have construction and operational impacts similar to those described in Chapter 4. Construction requirements for the expanded EES have not yet been estimated, but significant grading activity and material transport would be required. Fugitive dust emissions from on-site construction activities might exceed Clean Air Act *de minimis* levels, requiring a Clean Air Act conformity review.

Operating the EES would result in the potential for significant salt spray drift downwind of the site. The geographic extent of areas exposed to salt drift would be greater than that described in Chapter 4. If buffer areas around the system were limited, spray drift to offsite areas might exceed Clean Air Act *de minimis* levels. Constructing and operating the EES would require air quality permits from the relevant air pollution control agency, such as the Imperial County Air Pollution Control District or South Coast Air Quality Management District.

Mitigation for these air quality impacts would be the same as described in Chapter 4. These measures include developing and implementing a dust control plan, using electrically powered pumps for facility operations, siting EES modules and incorporating buffer zones to reduce public exposure to salt drift, and using automated controls to shut down some or all EES modules when hourly average wind speeds exceed 14 to 16 mph. However, even with implementation of these measures, fugitive dust emissions during construction may not be able to be reduced to a less than significant level.

Avian Resources

Bird species would benefit from improved water quality conditions in the Sea and the reduced salinity levels. However, similar to impacts described in Chapter 4, constructing an expanded EES could have significant and unmitigable impacts on upland avian species. For example, loss of foraging and nesting habitat could affect some avian species and the EES waters could be toxic to birds landing in the EES ponds and ingesting contaminants when preening. Other hazards could occur from bird exposure to sprayed EES waters and from collision with the spray towers. However, compared to impacts described in Chapter 4, there would be an increase in the number of avian losses from tower collisions, particularly during the night, and from salt encrustation as they fly through the spray.

Vegetation and Wildlife

Constructing the EES would result in a potentially significant adverse impact to plant communities due to the loss of large amounts of desert habitat. There would also be adverse impacts to the surrounding vegetation from the salt spray blowing from the EES, which could kill plants or stunt growth and reproduction. In addition special status species such as the desert tortoise and the flat-tailed horned lizard could be impacted depending on the location of the additional EES facilities.

Socioeconomics

An EES module processing 25,000 acre-feet per year would cost about $50 million to construct and $1.6 million per year to operate and maintain (in 1999 dollars). At an inflation-adjusted discount rate of 3.5 percent per year, the present capitalized cost of constructing and operating one module for 100 years is about $91 million. A 4-module expansion would thus cost $364 million. Construction of the EES would result in short-term economic benefits from regional employment and spending. Operation and maintenance would also provide minor benefits from employment of operations staff and subsequent spending.

A faster decline in salinity, if accompanied by reduced eutrophication and other improvements in water quality, could promote a faster recovery in the recreational use of the Sea and associated commercial development. Therefore, this alternative could provide the economic benefit of increasing the present value of future benefits from recreational use of the Sea.

Visual Resources and Odors

Constructing and operating the EES would result in potentially significant and unavoidable visual impacts. The massing, bulk, and color of the proposed expanded EES facilities would result in moderate to strong visual contrasts with the existing desert landscape in the Basin, as seen from key viewing observation points. Mitigation measures have been identified to reduce the effects of these impacts, including painting facilities a color that blends with the immediate natural desert landscape, using non-reflective materials, and emphasizing horizontal lines in facility design (see Section 4.13 for detailed measures). However, proposed project impacts would still be considered significant even after implementing these measures.

Beneficial odor impacts would occur if water quality conditions improved at the Sea, resulting in fewer algal blooms, fish kills, and avian kills.

Public Health and Environmental Hazards

Construction activities may create depressions in the ground surface that could collect water, creating isolated pockets of standing water that could become breeding habitat for the encephalitis mosquito. The increase in habitat could lead to an increase in the mosquito population, increasing the potential for transmission of mosquito-borne diseases to humans. The use of heavy equipment and watercraft to construct the EES would increase the potential for accidental spills of petroleum products, primarily fuels and oils. Because the volume of any accidental spills compared to the volume of the Sea likely would be minimal, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

As a result of operating the expanded EES, the chemical composition of the Sea would change, including a decrease in salinity, possibly increasing the survival rates of biological pathogens, leading to an increase in the potential health hazards associated with exposure to these pathogens. However, due to uncertainty about the future levels of these biological pathogens, the change in health effects related to their presence cannot be accurately predicted. The reduction in Sea level may reduce the amount of shoreline brackish vegetation, which is breeding habitat for the encephalitis mosquito. This could cause a decline in the mosquito population, reducing the potential for transmission of diseases from mosquitoes to humans. Pumping Sea water, which contains relatively low selenium concentrations, to the expanded EES likely would remove negligible amounts of selenium from the food chain. However, if operating the expanded EES results in lower selenium concentrations in fish and waterfowl, it would have a beneficial effect on fish and duck consumers. Improving the condition of the fishery may attract a greater number of anglers to the Sea, increasing the size of the population exposed to selenium via consumption of fish. The decline in Sea elevation may expose contaminated sediments along the Sea's perimeter and increase the potential for public exposure to airborne contaminants due to wind erosion of the sediments. The EES precipitation ponds, containing the Sea water constituents following evaporation of the water, could dry out, creating the potential for wind erosion. Because the susceptibility of sediments and the pond materials to erosion is not known, the potential for airborne health hazards resulting from operating the enhanced EES cannot be determined. If conditions at the Sea improve as a result of this alternative, recreational use of the Sea likely would increase, leading to a greater number of people that would exposed to potential hazards at the Sea and to increased releases of petroleum fuels and oils from motorized watercraft. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Operation of the EES towers would create the potential for drift of the concentrated Sea water and its constituents. If the expanded EES is constructed at Bombay Beach, winds at speeds below the 14 mile per hour system shutdown threshold may be capable of carrying these materials to Bombay Beach. Visitors to the beach could be exposed to airborne concentrations of salts and selenium. If the expanded EES is constructed at the Salton Sea Test Base, it is not likely that the public would be exposed to airborne salts and selenium due to the distance from the EES to populated areas.

Archaeological and Architectural Resources

Ground-disturbing activities associated with the EES could have a significant adverse impact on resources eligible for the NRHP within the area of potential effect (APE). Once the APE for the EES expansion has been defined, an archaeological record search would need to be conducted of the area. A survey of all unsurveyed portions would also need to be conducted. Identified resources would be evaluated for eligibility to the NRHP. Impacts to NRHP-eligible resources could be mitigated through avoidance, construction monitoring, or data recovery. The appropriate mitigation measure would be determined in consultation with the State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation (ACHP).

Ethnographic Resources

Ethnographic resources, such as traditional cultural properties (TCPs) and traditional use areas (TUAs), may be subject to adverse impacts from expanding the EES. Once the APE for the EES has been defined, sensitive resources within the APE would need to be identified through consultation with the appropriate Native American group(s). Impacts to Ethnographic resources are best mitigated through avoidance. When avoidance is not possible, mitigation measures should be determined in consultation with the appropriate tribal group or groups.

Paleontological Resources

Ground-disturbing activities associated with the EES could have adverse impacts on significant paleontological resources within the project area. Once the extent of the EES has been defined, the potential for this area to contain significant resources would need to be evaluated. If the project area contains a high potential for significant paleontological resources, monitoring ground-disturbing activities by a qualified paleontologist may be required to mitigate potential impacts.

Indian Trust Assets

The EES could have a significant impact on Indian Trust Assets. Once the extent of the EES has been defined, Indian Trust Assets within this area would need to be identified and impacts assessed. Impacts to Indian Trust Assets are best mitigated through avoidance. When avoidance is not possible, mitigation measures should be determined in consultation with the appropriate Native American tribal group or groups.

6.3.2 Export to Gulf of California

This alternative would pump water directly out of the Salton Sea to the Gulf of California through an enclosed pipeline that terminates at Golfo de Santa Clara, immediately outside of the UN-designated Biosphere. Alternately, the outfall structure could be extended approximately a mile into the Gulf of California. The screened intake structure would use the same design as that described for the EES and would be offshore of the Salton Sea Test Base site. The 112-inch diameter pipeline would convey 250,000 af/yr, or 345 cfs, and would be constructed of polymer-lined steel. The pipeline route would extend 140 miles and would require two pumping stations to lift the water 453 feet. It is expected that constructing and operating the facility to pump water from the Salton Sea to the Gulf of California would affect the environmental resources discussed below.

Surface Water Resources

Constructing the export pipeline to the Gulf of California would involve minor local impacts on surface water resources from erosion along the construction corridor caused by storm water runoff. The potential for these impacts would be limited to locations where the pipeline route lies along or crosses a perennial stream channel. These impacts would be minor because the region is arid, most channels are dry most of the year, and most of the streams in the area carry relatively high sediment loads.

Discharging Salton Sea water into the Gulf of California could potentially result in a significant impact on the receiving water. The Salton Sea brine would be higher in the concentration of total dissolved solids than the receiving water, and the concentrations of the individual dissolved and suspended constituents would differ from those in the receiving water. The Salton Sea water contains higher concentrations of nutrients than occur in the Gulf of California. In addition, Salton Sea water may contain organisms already adapted to saline conditions that are not found, or are not abundant, in the receiving water.

For the purposes of this analysis, the Upper Gulf of California extends from the mouth of the Colorado River a distance of about 40 miles south, or about as far as San Felipe. Within this region currents move relatively slowly and are part of a larger rotational system driven by winds, tides, and the shape of the shoreline. In the Upper Gulf, the rate of evaporation is greater than the rate of precipitation or inflow from streams. Therefore, wind and tidal change are the principal energy sources for moving water in the Upper Gulf. Tidal currents probably dominate, but tidal flushing is extremely slow in the Upper Gulf. It has been estimated that the waters of the Upper Gulf are exchanged at a rate of about once per year. This slow exchange with the larger circulation system of the Gulf in effect makes the Gulf act in some ways like a large lake. There is a natural salinity gradient in the Upper Gulf. The salinity in the vicinity of the mouth of the Colorado River is about 37,500 mg/L, and is about 2,000 mg/L lower in the main body of the Gulf, south of San Felipe. Adding salts or nutrients to this semi-closed system could cause the salts and nutrients to accumulate, much as they do in the Salton Sea.

The principal existing inflows to the Gulf of California in the region of the proposed Salton Sea outfall include Colorado River discharge, which contains agricultural return flows from irrigated lands in the U.S and Mexico, and saline agricultural wastewater discharge from the MODE Canal (the Wellton-Mohawk Drain in Yuma, Arizona). The MODE Canal does not discharge directly into the Gulf of California, but instead discharges into the upper portion of the Santa Clara Slough (Cienega de Santa Clara). Thus, the discharge rate of this water to the Gulf is governed by tidal action in the marsh. On its path to the Gulf, the water is able to spread out over a large area, where it mixes with water from the Gulf that move into the Santa Clara Slough on high tides. Nutrients and particulates are removed through biological processes and settling within the marsh. Based on historical records for 1979-1986, flows in the Wellton-Mohawk Drain at the Arizona-Sonora, Mexico border averaged about 200 cfs (about 144,000 AFY) (USGS 1999. Available from http://waterdata.usgs.gov/nwis-w/AZ). Salt concentrations in the MODE Canal are about 3,000 to 5,000 mg/L.

The water quality at the mouth of the Colorado River varies with the quantity of flow. Flows in the Colorado River at El Maritimo, about 48 miles downstream of the international boundary, reportedly range from nearly zero to several thousand acre-feet per year (Thomson et al. 1969). The concentration of salts in the discharge from the Colorado River is likely in the range of 3,000 to 5,000 mg/L on average. As flows increase, concentrations of dissolved constituents tend to be reduced by dilution and particulate loads tend to increase.

By contrast, the Salton Sea discharge would be a continuous, steady flow with a relatively stable constituent load. A rate of 250,000 AFY is approximately 345 cfs, or about two-thirds the rate of the MODE Canal. The concentration of the effluent would range from as low as 40,000 mg/L (assuming Alternative 4 with 1.06 mafy inflow), to 80,000 mg/L (assuming Alternative 1 with 0.8 mafy inflow). 40,000 mg/L is not much higher than the salt concentration in the Upper Gulf, which reportedly ranges between about 36,000 to 38,000 mg/L near El Golfo (Thomson et al. 1969). Thus, assuming that the effluent discharge rate would be about half the combined rates of the Colorado River and the MODE Canal combined, and that the average salt concentration in the existing inflows is on the order of on-tenth to one-twentieth the concentration of the Salton Sea effluent, the salt loading rate would be twenty to forty times higher than the loading rate of the existing inflows.

Discharging from a large number of small outfalls instead of from one large outfall could minimize the impacts on the receiving waters. This would allow the effluent to mix with the ambient water more rapidly over a large area, and would help to prevent stratification due to density differences. Thus, the principal water quality concerns would be the potential for large-scale salinity increases in the Upper Gulf, excessive nutrient loading, and potential acute toxic effects from chemical or biological constituents of the effluent. The later could also be minimized if the discharge were dispersed. Standard testing procedures could be used, or adapted, to monitor the toxicity of Salton Sea water to resident organisms, and to determine the appropriate discharge rates to achieve an appropriate degree of mixing.

Thomson et al. (1969) concluded that discharge of a large volume of brine (3.4 mafy) with a salinity of 45,800 mg/L into the Upper Gulf could create a hypersaline environment at the northern end of the Gulf. (3.4 mafy is approximately 13.4 times greater than the 250,000 AFY assumed in this report.)

Ground Water Resources

Export pipelines are not expected to leak. However, a failure of the pipeline could result in a temporary discharge of saline water. The size of a discharge due to a major failure in the pipeline has not been estimated. However, the pipeline is expected to be designed so that a leak would be detected and the flow shut off within a specified period of time. Such a discharge could have a significant local impact on ground water quality, depending on the location and duration of the release. Impacts on ground water are expected to be both unlikely to occur, and unlikely to be significant if they occur.

Geology and Soils

Known active faults that could be crossed by the proposed export pipeline include the Superstition Hills Fault and the San Jacinto Fault Zone. An approximate fault boundary extends northwestward from the northern edge of the Gulf of California and would be crossed by the proposed pipeline route. Earthquakes along these or other nearby faults could cause damage to the pipeline. Repairs to structural damage would be made under the long-term operation and maintenance program for the Salton Sea Restoration

Project, reducing the potential for these impacts to a less than significant level. Soil disturbance during pipeline construction would result in an increased potential for soil erosion. This impact is not expected to be significant due to the relatively level topography of much of the area crossed by the pipeline. In addition, construction and post-construction erosion-control measures would be implemented in areas where the pipeline crosses soils sensitive to wind and stream erosion. Potentially corrosive soils could damage the pipeline. Soils along the Sea margin are highly saline, and salt resistant construction materials would be used to construct any subsurface structures in this area.

Air Quality

Constructing an intake structure, 140 miles of pipeline, and two pumping plants could produce significant amounts of fugitive dust and vehicle emissions. Mitigation for this potential significant impact would require developing and implementing a dust control plan for construction sites, including haul roads and construction equipment staging areas. Furthermore, pumping plant operations probably would require air quality permits from the Imperial County Air Pollution Control District.

Noise

Constructing a pipeline from Salton Sea to the Gulf of California would result in temporary and intermittent noise effects along the length of the pipeline corridor. Noise would result primarily from earthmoving equipment and heavy truck traffic. Construction could raise noise levels over 80 dB in the immediate vicinity of the construction activity. However, noise levels would decrease with increasing distance from the construction site. Sensitive receptors have not been identified along the pipeline route, but any residences, schools, or other sensitive land uses near construction activities have the potential to be affected. Should construction cause a disturbance, limiting use of heavy construction equipment to normal daylight hours (7 AM to 7 PM) would reduce the effects of construction noise. Local city or county noise ordinances and guidelines may place additional restrictions on construction activities.

Fisheries and Aquatic Ecosystems

Potentially adverse impacts could occur to resident fish and benthic species and aquatic habitat in the Gulf of California due to the potential for further degradation of existing water quality problems. The upper Gulf of California is a relatively shallow body of water with poor circulation and lower dispersive potential. Consequently, the Gulf would have a limited ability to assimilate wastewaters. However, available information suggests that most deepwater outfalls, if designed and operated properly, can avoid any adverse environmental problems (Salton Sea Science Subcommittee 1999b) at least in a short term (i.e., less than twenty-five years) time frame. Limited information is available on the potential long-term consequences of disposal.

The Salton Sea Science Subcommittee is collecting information relative to all ocean-based export alternatives. The information from the outfall report will provide for a more detailed analysis in the immediate future.

Executive Order 13112 recently signed by President Clinton (February 3, 1999), states that introduction of invasive species (i.e., "an alien species whose introduction [export /import] does or is likely to cause economic or environmental harm") will not be allowed. This alternative would be contrary to the directive of this Executive Order. The possibility that Tilapia could be introduced into the Gulf of California would not be allowed under the authority of this Executive Order.

Avian Resources

Discharges from the Salton Sea to the Gulf of California may have significant impact to avian resources. As described above there is a potential to impacts aquatic resources including fish that may in turn affect fish eating birds.

Vegetation and Wildlife

Constructing a pipeline to the Gulf of California may have significant impacts to vegetation and wildlife. The pipeline could have an adverse impact to plant and wildlife communities, including sensitive species and habitats, due to the loss of habitat resulting from construction. The pipeline could impact local and/or regional wildlife migration routes. Once the route for the pipeline has been determined, it would need to be surveyed to determine if sensitive species or habitats could be affected. Impacts to these resources could be mitigated through construction monitoring and avoidance.

Socioeconomics

The Bureau of Reclamation has estimated that the operational cost to pump 100,000 to 400,000 acre-feet of water annually to be $6.6 to $26.4 million. Although the costs of pump and pipeline construction have not been precisely estimated, it is likely that such a system connecting the Salton Sea to a disposal site would cost upwards of $500 million. Total capitalized cost of construction and operation would likely be in the range of $0.7 to $1.2 billion.

If accompanied by reduction in eutrophication and other improvements in water quality, this alternative could result in benefits of substantial additional recreational use and commercial development.

Land Use and Planning

Constructing a pipeline extending from the Sea to the Gulf of California may have significant land use impacts. The proposed pipeline route would begin within El Centro County and cross the US/Mexico border into the states of Baja-California and Sonora. Although the route would avoid most urban and commercial uses, some uses near major highways could be affected. The majority of the route would be within desert or agricultural lands. Most of the route in the U.S would be within publicly withdrawn land (BLM and BOR) and private land. In Mexico, the route would mostly cross private land. The route mostly would follow existing road, canal, and railroad right-of-ways, and may be a compatible use in these areas. Land use compatibility would need to be evaluated for all affected jurisdictions once the final pipeline route is determined.

Agricultural Land Resources

A pipeline to transport water from the Sea to the Gulf of California may affect areas of agriculturally important lands in the Imperial Valley and lands in Mexico that may be comparable to those considered to be agriculturally important in California. Although the route in the US and Mexico mostly would be in desert areas, or would follow existing road, canal, and railroad right-of-ways, additional land in agricultural areas may still be necessary for construction. Once the final pipeline route is determined, the significance of agriculturally important farmland conversion would need to be evaluated using the LESA methodology. The area of farmland that may be influenced by this alternative is not likely to affect the agricultural economics of the area.

Recreational Resources

A determination of potential impacts to water quality and fisheries are required to ascertain potential recreation impacts to the Gulf of California discharge area. To the extent that this export alternative would contribute to stabilizing water quality, salinity levels, and water elevations in the Salton Sea, it would have a potentially beneficial impact on recreation uses and facilities at the Sea. However, potential effects on other recreational areas, facilities, or uses within the broader regional study area would need to be evaluated once the final pipeline route is determined.

Visual Resources and Odors

Depending on the location of the proposed pumping stations, sensitive visual receptors such as residences or recreationists could be adversely affected if the new stations create strong contrasts with the surrounding visual environment. Once the final location of pump stations is determined, the significance of this potential visual impact would need to be evaluated. Potential mitigation measures include painting and landscaping to reduce the level of contrast between the engineered features of the pump station and any adjacent natural features.

Public Health and Environmental Hazards

If Mexico has no comprehensive waste management regulations, then exporting Salton Sea water would be considered a nonmitigable significant adverse impact.

Pumping Salton Sea water, which contains various chemical constituents including selenium, to the Golfo de Santa Clara would increase the concentrations of those chemicals in the Golfo. Chemical concentrations would be highest near the pipeline outfall and would decrease with distance from the outfall. Because the concentrations of selenium and other chemicals in the Salton Sea are relatively low and these chemicals would be dispersed following discharge, it is not likely that they would present a potential hazard via the water or accumulation in fish; however, additional analysis and data gathering should be conducted to determine the level of potential health hazard, if any. Alternatively, extension of the outfall structure approximately one mile into the Gulf of California would further the distance the discharged water from populated areas. Biological pathogens likely would not survive being transported to the Golfo or the Gulf and, therefore, likely would not present a potential health hazard.

Exporting water from the Sea would reduce the levels of selenium in the water, possibly reducing selenium concentrations in fish and waterfowl, reducing the potential health hazard for fish and duck consumers. Improving the condition of the Sea may increase the survival rates and Sea levels of biological pathogens, increasing the potential for adverse health effects. If conditions at the Sea improve, recreational use of the Sea likely would increase, leading to a greater number of people that would exposed to potential hazards at the Sea and to increased releases of petroleum fuels and oils from motorized watercraft. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Archaeological and Architectural Resources

Ground-disturbing activities associated with constructing a pipeline from the Salton Sea to the Gulf of California could have a significant adverse impact on NRHP-eligible and other important resources located within the APE. Once the route for the pipeline has been determined, an archaeological record search would need to be conducted through the California Historical Resources Information System (CHRIS) and the Instituto Nacional de Antropología e Historia (INAH) of Mexico. Additionally, a survey of all unsurveyed portions of the APE would need to be conducted. Identified resources would be evaluated for eligibility to the NRHP or evaluated for significance based on Mexican law and INAH regulations. Impacts to NRHP-eligible or important resources could be mitigated through avoidance, construction monitoring, or data recovery. The appropriate mitigation measure should be determined in consultation with the SHPO, ACHP, INAH, and/or the Mexican government.

Ethnographic Resources

Ethnographic resources, such as TCPs and TUAs, may be subject to adverse impacts from constructing the pipeline from the Salton Sea to the Gulf of California. These impacts would be similar to those described for the EES; however, consultation must also be conducted with INAH and the Mexican government, and possibly with Mexican tribal groups in accordance with relevant Mexican laws and regulations, to identify ethnographic resources within APEs that lie in Mexico.

Paleontological Resources

Ground-disturbing activities associated with establishing a pipeline from the Salton Sea to the Gulf of California could have adverse impacts on significant paleontological resources within the project area. This impact would be similar to that described for the EES.

Indian Trust Assets

Constructing a pipeline from the Salton Sea to the Gulf of California could have a significant impact on Indian Trust Assets. This impact would be similar to that described for the EES.

6.3.3 Export to Pacific Ocean

This alternative would pump water directly out of the Salton Sea to the Pacific Ocean through an enclosed pipeline and tunnel that would terminate in Oceanside. The screened intake structure would use the same design as that described for the EES and would be offshore of the Salton Sea Test Base site. The 112-inch diameter pipeline would convey 250,000 acre-feet per year, or 345 cubic feet per second, and would be constructed of polymer-lined steel. It is expected that constructing and operating the facility to pump water from the Salton Sea to the Pacific Ocean would affect the environmental resources discussed below.

Surface Water Resources

The short-term effects of constructing the pipeline on surface water quality could include sediment discharge into perennial streams or other water bodies, or petroleum product spills or other materials associated with construction activity. The pipeline would cross or be routed near many streams, and disturbing stream channels or modifying land surfaces could alter runoff patterns. Effects could include locally increased flooding or erosion potential. These water quality and drainage effects are expected to be reduced to not significant levels by appropriate design and using best management practices during construction.

Although the general types of surface water impacts that may result from discharging Salton Sea water to the Pacific Ocean would be the same as described for the pipeline and discharge to the Gulf of California, the impacts are not expected to be significant. Along most of the Pacific Coast, including Oceanside, currents would be much more effective in dispersing effluent concentrations than in the Upper Gulf of California (Hickey 1979). No measurable increase in salinity of the receiving waters would be expected to occur beyond a distance of several tens of meters from the outfall.

Nutrient loading, and especially deposition of organic-rich solids, has been a concern of municipal wastewater discharges at some locations on the coast. However, the Salton Sea effluent would contain relatively low concentrations of suspended solids, and very small amounts of settleable solids compared to municipal wastewater. Similarly, the dissolved and suspended solids would not significantly reduce the dissolved oxygen content of the receiving waters. The receiving waters of the Pacific are high in dissolved oxygen, oxygen is replenished rapidly by wave action and photosynthesis, and dissolved oxygen concentrations are generally high within the potential depth range of the effluent outfall under existing conditions (Lynn et al. 1982).

The discharge rate of the Salton Sea effluent pipeline would be negligible compared to the bulk rate of water movement past the outfall in the ocean. The addition of dissolved nutrients at the concentrations of the Salton Sea would represent a negligible increase relative to ambient nutrient loads in the ocean (Thomas and Siebert 1974). Therefore, the effects of the discharge on ocean water quality are expected to be insignificant within a short distance of the outfall.

Ground Water Resources

The impacts of a failure of the pipeline would be similar to the impacts described above for the export pipeline to the Gulf of California. The pipeline to the Pacific would cross more riparian areas than the pipeline to the Gulf, and a discharge of saline water would have a greater probability of significantly impacting ground water resources. A pipeline failure would have a low probability of occurrence, but a high probability of causing a significant impact if it occurred.

Geology and Soils

Export to the Pacific Ocean would encounter the same types of seismic impacts and impacts related to corrosive soils as described for the pipeline to the Gulf of California. Soil disturbance during pipeline construction would increase the potential for soil erosion. The pipeline to the Pacific Ocean would cross areas with steep slopes and relatively substantial topographic relief west of the Sea. Implementing construction and post-construction erosion-control measures in areas where the pipeline crosses steep or unstable slopes or soils sensitive to wind and stream erosion would minimize this impact.

Air Quality

Potential air quality impacts associated with constructing an intake structure, pumping stations, and a pipeline from the Salton Sea to the Pacific Ocean would be the same as those described for export to the Gulf of California in Section 6.3.2. Furthermore, pumping plant operations probably would require air quality permits from the San Diego Air Pollution Control District.

Noise

Noise impacts from constructing a pipeline from the Salton Sea to the Pacific would be similar to those described for export to the Gulf of California.

Fisheries and Aquatic Ecosystems

Impacts to fisheries would be similar to those described for export to the Gulf of California, though discharge to the Pacific ocean would be less difficult because the physical oceanographic conditions along the southern California Coast are expected to facilitate rapid and thorough mixing and subsequent dispersion of Salton Sea effluent. Deepwater outfalls can provide much more rapid and thorough wastewater mixing and dispersion compared to relatively shallow-water outfalls. However, the possibility that Tilapia could be introduced into the Pacific would not be allowed under the authority of Executive Order 13112.

Vegetation and Wildlife

Impacts to vegetation and wildlife would be similar to those described for export to the Gulf of California and would be significant and mitigable.

Socioeconomics

Impacts would be similar to those described for export to the Gulf of California.

Land Use and Planning

Constructing a pipeline extending from the Sea to the Pacific Ocean near Oceanside, California may have significant land use impacts. The proposed route would be within Imperial and San Diego counties. The pipeline route would pass through land under a wide variety of ownership and administration including, for example, land administered by federal (BLM and USFS), state (California Department of Parks and Recreation), and local agencies, tribal land, and private land. A large portion of the pipeline would be underground and would not affect surface land uses. A majority of the land along the route would be public land managed for multiple use. Urban and commercial uses would be limited to small communities along the route and to the more developed area near the Ocean, or in developed areas adjacent the proposed right-of-way along Interstate 15 or State Route 76. Sections of the pipeline route may be within existing rights-of-way and may be a compatible use. Pipeline construction is likely to be incompatible with some land uses along the route. Land use compatibility would need to be evaluated for all affected jurisdictions once the final pipeline route is determined.

Agricultural Land Resources

The majority of this route would be through BLM, USFS, and CDPR lands. Small areas of agriculturally important farmland in western California could be affected, depending on the exact location of the pipeline corridor. Although this alternative is not likely to significantly affect agriculturally important farmland or agricultural economics, if it is determined that agriculturally important farmland is within the right-of-way, the significance of agriculturally important farmland conversion would need to be evaluated using the LESA methodology.

Recreational Resources

It is assumed that potential recreation-related impacts associated discharge in the Pacific Ocean would be negligible or insignificant. To the extent that this export alternative would contribute to stabilizing water quality, salinity levels, and water elevations in the Salton Sea, it would have a potentially beneficial impact on recreation uses and facilities at the Sea. However, potential effects on other recreational areas, facilities, or uses within the broader regional study area would need to be evaluated once the final pipeline route is determined.

Visual Resources and Odors

Potential visual impacts associated with constructing and operating pumping stations along the proposed pipeline route would be similar to those described for export to the Gulf of California in Section 6.3.2.

Public Health and Environmental Hazards

Pumping Salton Sea water, which contains various chemical constituents including selenium, to the Pacific Ocean would increase the concentrations of those chemicals in the ocean. Chemical concentrations would be highest near the pipeline outfall and would decrease with distance from the outfall. Because the concentrations of selenium and other chemicals are relatively low in the Salton Sea and these chemicals would be dispersed following discharge, it is not likely that they would present a potential hazard through contact with the water or accumulation in fish; however, additional analysis and data gathering should be conducted to determine the level of potential health hazard, if any. Biological pathogens likely would not survive being transported to the Pacific Ocean and, therefore, likely would not present a potential health hazard.

Exporting water from the Sea would reduce the levels of selenium in the water, possibly reducing selenium concentrations in fish and waterfowl, reducing the potential health hazard for fish and duck consumers. Improving the condition of the Sea may increase the survival rates and Sea levels of biological pathogens, increasing the potential for adverse health effects. If conditions at the Sea improve, recreational use of the Sea likely would increase, leading to a greater number of people that would exposed to potential hazards at the Sea and to increased releases of petroleum fuels and oils from motorized watercraft. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Archaeological and Architectural Resources

Ground-disturbing activities associated with constructing a pipeline from the Salton Sea to Oceanside could have a significant adverse impact on NRHP-eligible resources within the APE. This impact would be similar to that described for the EES.

Ethnographic Resources

Ethnographic resources, such as TCPs and TUAs, may be subject to adverse impacts from constructing the pipeline from the Salton Sea to Oceanside. These impacts would be similar to those described for the EES.

Paleontological Resources

Ground-disturbing activities associated with establishing a pipeline from the Salton Sea to Oceanside could have adverse impacts on significant paleontological resources within the areas of disturbance. This impact would be similar to that described for the EES.

Indian Trust Assets

Constructing a pipeline from the Salton Sea to Oceanside could have a significant impact on Indian Trust Assets. This impact would be similar to that described for the EES.

6.3.4 Export to Palen Dry Lakebed

This alternative either would pump water directly out of the Salton Sea or would pump concentrated brine water to the Lake Palen dry lakebed through an enclosed pipeline. The screened intake structure would use the same design as that described for the EES and would be offshore of the Bombay Beach site. The 112-inch diameter pipeline would convey 250,000 acre-feet per year, or 345 cubic feet per second, and would be constructed of polymer-lined steel. It is expected that constructing and operating the facility to pump water from the Salton Sea to the Lake Palen dry lakebed would affect the environmental resources discussed below.

Surface Water Resources

The short-term impacts on surface water of construction of a pipeline would be minimal, as described for the pipeline to the Gulf of California, because of the arid regional climate.

The impacts on surface water resources at Palen Lake are likely to be significant. Palen Lake is a dry lakebed, somewhat typical of the small terminal lakes in isolated basins throughout the region. Evaporation on the basin floor exceeds the inflow rate from the surrounding watershed. Annual rainfall in the region of Palen Lake is about 3 inches on the basin floor and up to about 5 to 6 inches in the surrounding ranges, but annual runoff to the valley floor is probably less than one-half inch per year (Hely and Peck 1964).

The evaporation rate on the basin floor at Palen Lake is probably a little higher than at the Salton Sea (Hely and Peck 1964), but for the purposes of this analysis, they can be assumed to be equal. The initial evaporation rates of the brine would be in the range of 5.5 feet per year, but would rapidly decrease to about 4.6 feet per year as the salinity of the water reaches its saturated concentration of about 260,000 mg/L. Therefore, it can be assumed that most of the time the evaporation rate would be 4.6 feet per year.

Once the saturation concentration is reached in the pond, salt would precipitate at the rate at which it is imported in the inflow. The water exported to Palen Lake would initially have a salinity of anywhere from 40,000 mg/L to 85,000 mg/L, depending on which Phase 1 alternative is assumed. Over time it would decrease as the salinity of the Sea is reduced.

Based on a pump-out rate from the Sea of 250,000 AFY, the evaporation pond would eventually rise to an elevation at which the surface area is 54,348 acres (85 square miles). It would take many years for the lake to reach this size since the basin is relatively flat and wide.

The amount of salt that must be removed from the Sea to reach the target salinity would vary depending upon the initial conditions at the beginning of Phase 2, and how much the current inflow may be reduced in the future. Assuming that the target salinity is met, that the target elevation is achieved as nearly as possible, and that supplemental water is available during Phase 2 from the sources described earlier in this section, the amount of salt that would be disposed at Palen Lake over the 70 year study period of Phase 2 would range from about 360 million tons (Alternative 4 with inflow reduced to 1.06 mafy) to 622 million tons (Alternative 4 with inflow reduced to 0.8 mafy).

Assuming that the specific gravity of the solid salt is about 2.5, the volume of the salt estimated above would be create a salt cake averaging about 2 to 3 feet thick over an area of about 85 square miles. In addition to salt, particulate matter would also be co-deposited with the salt. The particulate matter might increase the thickness of the deposits two- or three-fold.

Palen Lake is in the upper portion of the gradually-southeast sloping Chuckwalla Valley. The lowest elevation on Palen Lakebed is about 427 feet msl. The land rises slightly near the foot of the Palen Mountains, and then continues to slope downward, between the mountains and Interstate 10, until it reaches the deepest part of Chuckwalla Valley, at Ford Dry Lake. The ridge separating Palen Dry Lake from the lower part of Chuckwalla Valley is only one or two feet above the deepest point in Palen Lakebed. Therefore, the Palen Lakebed topography would prevent water from being stored there. A dam would be required to retain the water in the Palen Lake portion of the valley. The height of the dam would depend upon the topography of the Palen Lake basin, but it is likely to need to be at least 15 to 20 feet high to accommodate the expected volume of water, salt, and sediment, plus storm runoff.

Among the surface water impacts of this export alternative would be impacts associated with dam failure, lateral seepage of saline water through the sandy alluvial sediments on the margins of the valley, and potential effects on the quality of water in the washes downgrade from Palen Lake. While these washes carry only occasional flows, the water quality may be relatively high and may support vegetation and wildlife. A large saline lake could create salt springs down gradient of the dam. A failure of the dam could have significant impacts due to flooding of portions of the lower Chuckwalla Valley, and would leave a salt residue that would continue to be transported toward Ford Dry Lake.

Ground Water Resources

The impacts of a pipeline failure on ground water resources would be similar to those described for the pipeline to the Gulf of California.

Since this alternative requires a discharge to land, there is likelihood for ground water to be impacted at the discharge site in Palen Lake. Palen Lake is a playa lakebed. The ground water underlying the central portion of the basin is expected to be saline. However, based on evaluation of the topographic map of the area, it appears that Palen Lake is not the terminal lake of Chuckwalla Valley. Groundwater flow may continue toward the Ford Dry Lakebed to the southeast. A subsurface hydrologic barrier is suspected at the southeast end of Palen Lake, possibly a bedrock extension of the Palen Mountains. Such a subsurface feature may serve to restrict the flow of ground water to the southeast, except when the water table is sufficiently high to flow over the barrier. And surface flows toward Ford Dry Lake are suspected to occur whenever the surface of Palen Lake is higher than about two feet. Because of the potential for ground water and surface water to move in the direction of Ford Dry Lake, and thus limit the accumulation of salts, it is possible that the quality of ground water beneath or in the general vicinity of Palen Lake is better than expected for a typical terminal lake. If so, placing brine on the lakebed could result in significant degradation of the existing ground water quality upgradient of Ford Dry Lake.

Geology and Soils

Export to Lake Palen would encounter the same types of geologic impacts as described for the pipeline to the Gulf of California (see Section 6.3.2).

Air Quality

Potential air quality impacts associated with constructing an intake structure, pumping stations, and a pipeline from the Salton Sea to Lake Palen in Riverside County would be the same as those described for export to the Gulf of California in Section 6.3.2. Furthermore, pumping plant operations probably would require air quality permits from the applicable air pollution control district, such as Imperial County Air Pollution Control District, South Coast Air Quality Management District, or Mojave Desert Air Quality Management District.

Noise

Noise impacts from constructing a pipeline from Salton Sea to Lake Palen would be similar to but less than those described for export to the Gulf of California or the Pacific because the pipeline distance would be shorter and through less developed and less noise-sensitive areas.

Avian Resources

There is the potential for a significant adverse impact on birds if Lake Palen becomes filled. This event could create conditions for an outbreak of avian botulism that occurred the last time water filled Lake Palen.

Vegetation and Wildlife

Potential significant adverse impacts to vegetation and wildlife would be similar to those described for export to the Gulf of California. In addition, this alternative would have an overall adverse impact to vegetation and wildlife species due to flooding at Lake Palen.

Socioeconomics

Impacts would be similar to those described for export to the Gulf of California.

Land Use and Planning

Constructing a pipeline from the Sea to Lake Palen may have significant land use impacts. Land along the proposed route is entirely within Riverside County and is mostly public land administered for multiple use. The route may also pass through the Chocolate Mountains Gunnery Range administered by the US Marine Corps, the Salton Sea Recreation Area administered by the California Department of Parks and Recreation, and private land. This area is very sparsely populated and little or no urban or commercial uses are likely to be affected. Land use compatibility would need to be evaluated for all affected jurisdictions once the final pipeline route is determined.

Recreational Resources

Depending on the rate of discharge and evaporation/absorption rates at Lake Palen, water discharge could impact existing off-road vehicle use areas in the vicinity. To the extent that this export alternative would contribute to stabilizing water quality, salinity levels, and water elevations in the Salton Sea, it would have a potentially beneficial impact on recreation uses and facilities at the Sea. However, potential effects on other recreational areas, facilities, or uses within the broader regional study area would need to be evaluated once the final pipeline route is determined.

Visual Resources and Odors

Potential visual impacts associated with constructing and operating pumping stations along the pipeline route would be similar to those described for export to the Gulf of California in Section 6.3.2.

Public Health and Environmental Hazards

Because the body of water created by pumping Salton Sea water to the Palen Dry Lakebed would have no outlet and would be subjected to high evaporation rates, it would have high salinity and concentrations of chemicals, including selenium, greater than in the Salton Sea. As the water evaporates, the chemical constituents of the water may be left behind in a perimeter crust surrounding the water body. These chemicals may be subject to wind erosion; however, due to the lake's distance from populated areas, it is not likely to result in exposure of people to airborne hazards. Because there would be no public access to the lake, there would be no other public health effects associated with the lake. The effects of pumping concentrated brine would be similar to the effects of pumping Salton Sea water. However, due to the increased contaminant concentrations in the concentrated brine, salinity and chemical concentrations in the lake would be greater.

Exporting water from the Sea would reduce the levels of selenium in the water, possibly reducing selenium concentrations in fish and waterfowl, reducing the potential health hazard for fish and duck consumers. Improving the condition of the Sea may increase the survival rates and Sea levels of biological pathogens, increasing the potential for adverse health effects. If conditions at the Sea improve, recreational use of the Sea likely would increase, leading to a greater number of people that would exposed to potential hazards at the Sea and to increased releases of petroleum fuels and oils from motorized watercraft. The volume of these releases compared to the volume of the Sea likely would be minimal; therefore, the potential for adverse health effects from exposure to petroleum products in Sea water is low.

Archaeological and Architectural Resources

Ground-disturbing activities associated with constructing a pipeline from the Salton Sea to Lake Palen could have a significant adverse impact on NRHP-eligible resources located within the APE. This impact would be similar to that described for the EES.

Ethnographic Resources

Ethnographic resources, such as TCPs and TUAs, may be subject to adverse impacts from constructing the pipeline from the Salton Sea to Lake Palen. These impacts would be similar to those described for the EES.

Paleontological Resources

Ground-disturbing activities associated with establishing a pipeline from the Salton Sea to Lake Palen could have adverse impacts on significant paleontological resources within the areas of disturbance. This impact would be similar to that described for the EES.

Indian Trust Assets

Constructing a pipeline from the Salton Sea to Lake Palen could have a significant impact on Indian Trust Assets. This impact would be similar to that described for the EES.

6.4 IMPORT WATER THROUGH YUMA, ARIZONA

This alternative would involve pumping reject water from a water treatment facility from Yuma to the Salton Sea. The water would be brought from the Central Arizona Salinity Interceptor (CASI), designed to transport brackish water by gravity from the Tucson and Phoenix areas to Yuma. This water would be less saline than existing inflows to the Sea and would help reduce salinity and stabilize elevation if inflows are significantly reduced. This water is expected to be available in approximately 25 years with the current plans for disposal including discharge to the Gulf of California. Approximately 304,800 acre-feet per year are estimated to become available for diversion to the Salton Sea. This amount of CASI water could be conveyed continuously at approximately 420 cfs. Due to water quality issues, this water cannot be mingled with Colorado River water and thus would require construction of a new canal or pipeline to convey the CASI water to the Salton Sea. It is anticipated that this conveyance structure would parallel the existing All American canal. It is expected that importing water through Yuma, Arizona would affect the environmental resources discussed below.

Surface Water Resources

Importing water from the CASI project would have the beneficial impact of helping to restore the Salton Sea while possibly preventing or reducing the potential adverse effects of its disposal in the Gulf of California.

The quality of this water is not known, but is expected to have a salt concentration of about 5,000 mg/L. While this is considerably higher than most of the other inflow sources being considered, it would still benefit the Sea because the salt concentration would be about seven times lower than the target salinity of the Sea. Among the potential adverse impacts of importing CASI water would be the effect of any trace elements, such as selenium, nutrient concentrations, or pesticide and herbicide residues that may be concentrated in the water.

Ground Water Resources

No impacts on groundwater are expected to occur from the transfer of CASI water by canal or pipeline.

Geology and Soils

The geology and soils impacts due to pumping treated water from Yuma to the Salton Sea would be similar to those discussed for the export alternatives. Soil disturbance during channel construction would result in the increased potential for soil erosion.

However, the relatively level topography of the area and implementation of construction and post-construction erosion-control measures where soils sensitive to wind and stream erosion are crossed would minimize this to a less than significant level.

Potentially significant structural impacts to the canal due to ground rupture and ground acceleration would be minimized to a less than significant level through the repairs and maintenance conducted as part of the Salton Sea Restoration Project.

Socioeconomics

The costs of this alternative cannot be estimated this time. It can be anticipated, though, that construction costs should be comparable to those of water-export schemes. Also, operating expenses should be less than those of water export schemes, as gravity flow would reduce power requirements for pumping water import.

Importing water would economically benefit the immediate area around the Sea, by preventing a substantial change in shoreline location and configuration.

Positive socioeconomic benefits are expected from employment and material purchases during the construction phase. During the operational phase, this measure would be expected to contribute to the overall economic benefit of the restoration program. In addition, operation and maintenance of the canal may create new positions for permanent employees.

Air Quality and Noise

Air quality and noise effects are expected to be minor. Standard construction practices would be employed to control air emissions and noise due to construction. No operational air quality or noise impacts are expected. Air quality permits may be required to operate pumping plants that may be needed to transport water to the Salton Sea.

Fisheries and Aquatic Ecosystems, Avian Resources, and Vegetation and Wildlife

Effects on fisheries, bird species and other biological resources are expected to be beneficial due to stabilization of shoreline and reduced salinity.

Land Use and Planning and Agricultural Resources

This action is not expected to affect land use and planning or agricultural resources. Constructing a transport canal adjacent to the All American Canal may have significant land use impacts. While the portions of the route would be in desert lands and would parallel the existing right-of-way for the All American Canal, commercial and public uses near major highways and agricultural uses could be affected. Most of the route would be within publicly withdrawn land (BLM and BOR) and private land. Land use compatibility would need to be evaluated for all affected jurisdictions once the final pipeline route is determined.

Constructing a transport canal adjacent to the All American Canal may affect areas of agriculturally important lands in the Imperial Valley. Although the route mostly would be in desert areas, or would parallel the existing right-of-way for the All American Canal, additional land in agricultural areas may still be necessary for construction. Once the final pipeline route is determined, the significance of agriculturally important farmland conversion would need to be evaluated using the LESA methodology. The area of farmland that may be influenced by this alternative is not likely to affect the agricultural economics of the area.

Recreational Resources

To the extent that this import alternative would contribute to the overall improvement of Salton Sea salinity levels and to the stabilization of the water surface elevation, it is viewed as having a potentially beneficial impact on recreation users and facilities.

Visual Resources and Odors

This action could result in short term visual impacts during construction of the pipeline from Yuma to the Salton Sea but would not result in permanent impacts to visual resources. Imports of CASI water could contribute to an overall improvement of odors at the Sea through improved water quality.

Public Health and Environmental Hazards

Introducing treated water to the Sea may dilute concentrations of chemical constituents present in the Sea water. A reduction in the selenium concentration may reduce the presence of selenium in the food chain, resulting in beneficial impacts to fish and duck consumers. However, because the chemical composition of this water is not known, the water could contain selenium and other constituents. These constituents could be concentrated by evaporation as the water is transported to the Sea, creating a new inputs to the Sea.

Utilities and Public Services

No significant impact.

Archaeological and Architectural Resources

Conveyance of water from Yuma, Arizona to the Salton Sea would require construction of a new canal that would parallel the All American Canal. Ground-disturbing activities associated with the construction of the canal have the potential to affect cultural resources. Prior to construction, compliance with Section 106 of the National Historic Preservation Act must be accomplished. This includes the identification and evaluation of any cultural resources within the APE of the proposed canal, and the development of mitigation measures in consultation with SHPO and ACHP.

Ethnographic Resources

Construction of a new canal could adversely effect ethnographic resources in the canal vicinity, including Pilot Knob. Consultation with the Quechan, Cocopah, and any other Native American group with religious or cultural connections to the areas encompassing the proposed route of the new canal should be conducted prior to commencing any construction activities to identify all ethnographic resources, including TCPs and TUAs within the APE. Mitigation measures for impacts to Pilot Knob or other ethnographic resources would have to be developed in consultation with the appropriate Native American groups.

Paleontological Resources

Ground-disturbing activities associated with construction of a new canal from Yuma to the Salton Sea could have adverse impacts on significant paleontological resources within the APE. This impact would be similar to that described for the EES.

Indian Trust Assets

Construction of a new canal from Yuma, Arizona to the Salton Sea could adversely affect Indian Trust Assets on Fort Yuma. Consultation with the Ft. Yuma Quechan and the Cocopah may be required before construction activities commence to identify and assess impacts. Impacts to Indian Trust Assets are best mitigated through avoidance. When avoidance is not possible, mitigation measures should be determined in consultation with the appropriate Native American tribal group or groups.

Environmental Justice

Construction of a new canal from Yuma, Arizona to the Salton Sea could have adverse impacts on Indian Trust Assets of the Quechan and Cocopah, two minority populations.

6.5 CUMULATIVE IMPACTS

Phase 2 actions would be implemented around the year 2030. It is difficult to forecast what other projects may be implemented that could have cumulative effects beyond those discussed here, when combined with Phase 2. No projects have been identified in the immediate Salton Sea area that would cause additional impacts. It is possible that other projects in the vicinity of the export and import pipelines could cause some cumulative effects, as discussed below.

Surface Water Resources

The combination of reductions in flows through the Colorado River and increased conservation and irrigation efficiency throughout the Colorado River Delta region, plus the continuation of discharges through the MODE Canal, may increase the severity of salinity impacts on the waters of the Upper Gulf of California. Discharging Salton Sea water to the Pacific Ocean would add incrementally to the discharges from various point and non-point sources along the coast, both existing and planned. The effects of the Salton Sea's contribution to these cumulative effects is not likely to be significant due to the capacity of the Ocean to dilute salts and nutrients.

Importing CASI water to the Salton Sea would contribute to a beneficial cumulative impact on the waters of the Gulf of California by providing an alternative, higher use of the water. If the wastewater were diverted to the Salton Sea instead of to the Colorado

River Delta, the CASI project would reduce the net quantity of salts transported into the Delta. This benefit would come at the expense of increasing the salt loading to the Salton Sea basin, but would benefit the Salton Sea restoration objectives.

Ground Water Resources

The project alternatives are not likely to contribute to any significant impacts on ground water resources, in combination with other existing or foreseeable projects, other than the impacts discussed above.

None of the proposed Phase 2 conditional actions is expected to contribute to an adverse impact when viewed in combination with other existing or foreseen projects in the study area.

Land Use and Planning and Agricultural Resources

Because of the large scale of Phase 2 export and import alternatives, these actions may significantly contribute to cumulative land use impacts. The contribution of each alternative is likely to be fairly small in most cases unless significant development begins to occur in the affected areas. Export to the Pacific Ocean is most likely to significantly contribute to cumulative land use impacts because of its route through heavily developed areas near the Ocean.

Phase 2 actions are not likely to significantly affect agriculturally important farmland or agricultural productivity and contribute to a cumulative impact.

Public Health and Environmental Hazards

Constructing the Lewis Drain Treatment Facility would remove selenium, nutrients, and pesticides from agricultural wastewater, possibly the concentration of these chemicals in the Sea. The Brawley Wetlands Construction Project and Brawley Wetlands Research Facility would remove contaminants from agricultural wastewater and the New River, thus reducing the contaminant loading and possibly reducing concentrations in the Sea. The potential reduction in selenium levels entering the Sea resulting from the cumulative projects may reduce selenium in fish and waterfowl, resulting in beneficial health effects for fish and duck consumers. The wetlands projects likely would increase breeding habitat for the encephalitis mosquito, thus increasing the potential for transmission of diseases from mosquitoes to humans.

Cultural Resources

Significant cumulative impacts could occur to archaeological resources within the Salton Sea Basin from any of the export and import alternatives when considered together with other projects currently underway or proposed in the region. Any ground disturbance has the potential to disturb or destroy archaeological resources. The loss of these non-renewable resources, and the information that they may contain, may result in a significant cumulative impact on the resource base of the region.

Significant cumulative impacts also could occur to ethnographic resources within the Salton Sea Basin from any of the export and import alternatives when considered together with other projects underway or proposed in the region. Any ground disturbance or new construction has the potential to disturb or destroy sensitive ethnographic resources. The loss of these non-renewable resources, or decreased access to resources by Native American groups, may result in a significant cumulative impact on the affected resource(s).

Indian Trust Assets

Significant cumulative impacts also could occur to Indian Trust Assets located on tribal reservations within the Salton Sea Basin from any of the export and import alternatives when considered together with other projects underway or proposed in the region. Any ground disturbance or new construction has the potential to disturb or destroy Indian Trust Assets such as mineral or cultural resources. The loss of these non-renewable resources may result in a significant cumulative impact on the affected resource(s).

Paleontological Resources

Significant cumulative impacts could occur to paleontological resources within the Salton Sea Basin from any of the export and import alternatives when considered together with other projects currently underway or proposed in the region. Any ground disturbance has the potential to disturb or destroy paleontological resources. The loss of these non-renewable resources, and the information that they may contain, may result in a significant cumulative impact on the resource base of the region.

CHAPTER 7
OTHER CEQA/NEPA TOPICS

7.1 GROWTH-INDUCING IMPACTS

Section 21100(b)(5) of CEQA requires that an EIR discuss the growth-inducing impacts of a proposed project. CEQA Guidelines Section 15126.2(d) clarifies this requirement, stating that an EIR must address "the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly in the surrounding environment." In addition, under authority of NEPA, the CEQ NEPA Regulations require consideration of the potential indirect impacts of a proposed project within an EIS. Indirect impacts of an action include those that occur later in time or farther away in distance but that are still reasonably foreseeable (CEQ NEPA Regulation Section 1508.8[b]).

The CEQA Guidelines and the CEQ NEPA Regulations identify several ways in which a project could have growth-inducing impacts. In addition to the characteristics described above, projects that remove obstacles to population growth and projects that encourage and facilitate other activities that are beyond those proposed as part of the project and that could affect the environment are considered growth-inducing (CEQA Guidelines Section 15126.2[d]).

Potential inducements to population growth include the availability of adequate water supplies, the availability of sewage treatment facilities, the availability of developable land, the types and availability of employment opportunities, housing costs and availability, commuting distances, cultural amenities, climate, and local government growth policies contained in general plans and zoning ordinances.

Section 1508.8(b) of the CEQ NEPA Regulations notes that indirect effects can include "growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystem."

Growth inducement may not be considered necessarily detrimental, beneficial, or of significance under CEQA. Induced growth is considered a significant impact only if it directly or indirectly affects the ability of agencies to provide needed public services or if it can be demonstrated that the potential growth, in some other way, significantly affects the environment, i.e., that it requires constructing facilities that would adversely affect the environment.

The growth-inducing impacts analysis discusses the restoration effort in two phases. Phase 1 alternatives have a design life of approximately 30 years and could additionally have a long-term utility with the implementation of Phase 2 alternatives. Implementing Phase 2 actions would extend efforts initiated by Phase 1 actions and would extend the life of the project to at least 100 years. Phase 2 alternatives have been analyzed in less detail than Phase 1 alternatives because of the uncertainties inherent in evaluating actions not scheduled to occur for at least 25 years.

Analyses of environmental effects include a discussion of growth-inducing impacts and other effects related to changes in land use patterns, population density, or growth rate. The location, timing, and magnitude of economic and population growth within a region are determined by many interrelated economic, social, and political factors, including the following:

- Employment opportunities (both direct and indirect);
- Availability and cost of natural resources, including land, water, and energy;
- Availability and cost of housing;
- Adequacy of community infrastructure (such as transportation facilities, fire and police protection, schools, recreational facilities); and
- Local government policy concerning growth issues (such as zoning ordinances and general plans).

Because each of these variables influences growth, it is difficult to determine whether a change in one of them is sufficient to cause a significant change in community growth rates.

As described in Chapter 1, there have been five goals identified for the Salton Sea Restoration Project. Two of these goals would result in growth in the Salton Sea area. Goal 3 is to restore recreational uses at the Sea, and Goal 5 is to identify opportunities for economic development around the Sea. For the purposes of this EIS/EIR the assumption is that the improved condition of the Salton Sea will stimulate economic growth in the area.

Potentially growth-inducing impacts for each phase are summarized in Table 7-1.

Table 7-1
Summary of Growth-Inducing Impacts

Phase/Alternative	Impacts
No Action Alternative	No growth-inducing impacts. Instead, recreational use and related commercial activities and property values would decline.
Alternative 1	Negligible to slightly positive economic and recreational impacts through life of project. Implementation of export and import alternatives would increase economic and recreational activity in the Salton Sea area. Export alternatives may have negative effects on receiving locations.
Alternative 2	Negligible to slightly positive economic and recreational impacts to 2050. After 2050, positive economic and recreational impacts. Implementation of import alternatives would increase economic and recreational activity in the Salton Sea area.
Alternative 3	Negligible to slightly positive economic and recreational impacts to 2050. After 2050, positive economic and recreational impacts. Implementation of import alternatives would increase economic and recreational activity in the Salton Sea area.
Alternative 4	Negligible to slightly positive economic and recreational impacts to 2050. After 2050, positive economic and recreational impacts. Implementation of import alternatives would increase economic and recreational activity in the Salton Sea area.
Alternative 5	Negligible to slightly positive economic and recreational impacts through life of project. Implementation of export and import alternatives would increase economic and recreational activity in the Salton Sea area. Export alternatives may have negative effects on receiving locations.
Common Actions	Negligible to slightly positive economic and recreational impacts to 2050 and beyond.

7.1.1 Potentially Significant Impacts

Potentially significant growth-inducing impacts would not occur until after 2050. Construction of any of the Phase 1 alternatives would result in positive short-term economic impacts from increased employment, spending, and business volume related to construction activities. During Phase 1 (30 years), employment and expenditures of the restoration program would have a small positive effect on the local economy. However, these beneficial effects are expected to be minor to negligible during Phase 1 until target levels are achieved for salinity and elevation, after 2050. After 2050, implementation of Phase 2 alternatives in conjunction with Phase 1 would substantially increase the recreational use of the sea and the economic growth in the area. The exact location of the growth is difficult to identify. However, local land use plans and existing environmental regulations and plans in the Salton Sea area will dictate where growth is allowed.

7.1.2 Mitigation Strategies

Because growth-inducing impacts would result primarily from improvements to the Salton Sea, the mitigation measures for potential growth-inducing impacts generally consist of existing laws and policies regulating development. For project alternatives that result in long-term changes in land use and land use patterns, existing planning and land management documents may need to be revised.

7.2 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term impacts versus long-term productivity for each resource considered in the EIS/EIR is summarized in Table 7-2. In general, adverse short-term impacts are related to construction activities and are identified for most resources. However, restoration of the Salton Sea had long-term benefits for some resources, including water quality, biological resources (including vegetation and wildlife, fisheries and aquatic ecosystems, and avian resources), socioeconomics, land use, aesthetics, public health and environmental hazards, and Indian Trust Assets.

7.2.1 Irreversible and Irretrievable Commitments of Resources

Irreversible impacts are those that cause, through direct or indirect effects, use or consumption of resources so that they cannot be restored or returned to the original condition, despite mitigation efforts. If unavoidable, the potentially irreversible impacts are documented in this report. An irretrievable impact or commitment of resources occurs when a resource is removed or consumed. These types of impacts are evaluated to assure that consumption is justified. A summary of potential irreversible and irretrievable commitments of resources is presented in Table 7-3.

Table 7-2
Summary of Short-term and Long-term Impacts

Resource	Impact Summary
Surface Water	Without project, salinity of the Sea would continue to increase, thereby continuing to adversely affect surface water quality. Short-term water quality impacts would occur with alternatives requiring dredging or disturbing the Sea. Long-term benefits to water quality would occur.
Ground Water	Without project, salinity of the Sea would continue to increase, thereby potentially continuing to adversely affect ground water quality. Long-term benefits to ground water quality would likely occur.
Geology and Soils	For all alternatives, short- and long-term commitment of resources (loss of soils) would occur during construction.
Air Quality	Short-term but significant emissions during construction periods for all alternatives. Potentially significant salt drift affecting areas immediately downwind of EES system facilities in alternatives 2, 3, and 4. Additional construction emissions and facility operational emissions from fish harvesting programs and wildlife/fisheries programs requiring creation of artificial islands or large pond systems.
Noise	For all alternatives, short-term, localized and intermittent increases in noise levels would occur during construction. Minor operational impacts would occur both short- and long-term.
Fisheries and Aquatic Ecosystems	Without project, increased salinity and degraded water quality of the Sea would continue to adversely affect resources. Short-term loss of habitat would occur with alternatives disturbing the Sea. Long-term habitat restoration and improvement would occur with all alternatives. Potential impacts associated with long-term export alternatives may affect resources at receiving location.
Avian Resources	Without project, increased salinity and degraded water quality of the Sea would continue to adversely affect resources. Short-term loss of habitat could occur. Long-term habitat restoration and improvement would occur with all alternatives.
Vegetation and Wildlife	Without project, increased salinity and degraded water quality of the Sea would continue to adversely affect resources. Short-term loss of habitat would occur with alternatives disturbing the Sea. Long-term habitat restoration and improvement would occur with all alternatives. Potential impacts associated with long-term export alternatives may affect resources at receiving location.
Socioeconomics	For all alternatives, short-term increases in economic activity would occur during construction. Negligible socioeconomic impacts would occur until 2050, after which all alternatives would have a net positive effect.
Land Use and Planning	Some land use incompatibilities would occur with some Phase 1 alternatives. Potential long-term benefits because of enhanced value of areas designated for residential, urban, and recreational uses. Phase 2 export alternatives and one import alternative would permanently commit land for pipelines in the long-term.
Agricultural Land Resources	No short-term losses. One Phase 2 alternative may result in loss of agricultural productivity in the long-term.
Recreational Resources	Short-term negative effects. Slight positive impacts as Sea elevation and salinity stabilize. Long-term beneficial impacts.

Table 7-2
Summary of Short-term and Long-term Impacts *(continued)*

Resource	Impact Summary
Aesthetics	Construction of EESs would have short- and long-term impacts. Long-term benefits to aesthetic character of the area.
Public Health and Environmental Hazards	Short-term construction impacts associated with dredging or moving contaminated soils. Long-term beneficial impacts due to decreased contaminant concentrations in the Sea. Potential negative long-term impacts at receiving locations of Phase 2 export alternatives.
Utilities and Public Services	Minor short-term adverse impacts related to the removal and replacement of electric utility lines would occur with construction. Long-term impacts during Phase 1 would be negligible. Adverse long-term impacts could occur during Phase 2 if the demands of economic growth surpass the capacity of utilities and public services.
Cultural, Native American, and Paleontological Resources	Ground-disturbing activities (both short-term and long-term) required for all Phase 1 and Phase 2 alternatives could result in the permanent loss of important nonrenewable cultural, Native American, and paleontological resources. No long-term benefits would occur.
Indian Trust Assets	Ground-disturbing activities (both short-term and long-term) required for all Phase 1 and Phase 2 alternatives could result in the permanent loss of important nonrenewable Indian Trust Assets. Potential for long-term benefits from improved economic conditions in the area.
Environmental Justice	For all alternatives, construction activities that disturb the Sea floor (such as dredging) may affect inundated Native American resources. Potential for long-term benefits from improved economic conditions in the area.

Table 7-3
Summary of Potentially Irreversible and Irretrievable Commitments of Resources

Resource	Impact Summary
Surface Water	No irreversible or irretrievable impacts.
Ground Water	No irreversible or irretrievable impacts.
Geology and Soils	The use of borrow soil to construct the infrastructure required for all Phase 1 and Phase 2 alternatives would result in an irreversible and irretrievable commitment of these resources.
Air Quality	No irreversible or irretrievable impacts.
Noise	No irreversible or irretrievable impacts.
Fisheries and Aquatic Ecosystems	Some loss or alteration of habitat would occur from facilities construction.
Avian Resources	Some loss or alteration of habitat would occur from facilities construction.
Vegetation and Wildlife	Some loss or alteration of habitat would occur from facilities construction.
Socioeconomics	No irreversible or irretrievable impacts.
Land Use and Planning	Construction of the infrastructure required for all Phase 1 and Phase 2 alternatives would result in a long-term or permanent conversion of land, which would not be available for other uses.
Agricultural Land Resources	No irreversible or irretrievable impacts for Phase 1 activities and most Phase 2 activities. One Phase 2 alternative (Export to Gulf of California) may result in irretrievable commitment of agriculturally important lands.
Recreational Resources	No irreversible or irretrievable impacts.
Aesthetics	The construction of the infrastructure required for all Phase 1 and Phase 2 alternatives would result in permanent and irreversible changes to the visual nature of the area.
Public Health and Environmental Hazards	No irreversible or irretrievable impacts.
Utilities and Public Services	No irreversible or irretrievable impacts.
Cultural, Native American, and Paleontological Resources	Ground-disturbing activities required for all Phase 1 and Phase 2 alternatives could result in the irreversible/irretrievable loss of important cultural, Native American, and paleontological resources.
Indian Trust Assets	Ground-disturbing activities required for all Phase 1 and Phase 2 alternatives could result in the irreversible/irretrievable loss of important Indian Trust Assets.
Environmental Justice	Ground-disturbing activities required for all Phase 1 and Phase 2 alternatives could result in the irreversible/irretrievable loss of important Native American resources.

CHAPTER 8
PUBLIC AND AGENCY INVOLVEMENT

8.1 INTRODUCTION

Since the initial stages of the Salton Sea Restoration Project, stakeholder outreach and education and agency participation have been a primary focus of efforts in the shaping of the project and in the development of alternatives for the EIS/EIR. Although salinity and surface water elevation problems at the Sea have been studied for many years, the initial planning process for the current set of alternatives began in 1996. The process has included numerous public and agency meetings. Meetings have been held to help identify potential alternatives, develop screening criteria, conduct screening analysis (with public and agency input) to eliminate some alternatives and focus on feasible alternatives, and give the public updates about which alternatives would be retained for analysis in the EIS/EIR.

8.2 LEAD AND COOPERATING AGENCIES

The Bureau of Reclamation (Reclamation) and the Salton Sea Authority (Authority) have entered into an agreement to coordinate and perform studies and investigations necessary to implement Public Law (PL) 105-372 and PL 105-575. Under this agreement, Reclamation and the Authority are jointly responsible for addressing environmental impacts and are the lead agencies for preparing the EIS/EIR. Reclamation is responsible for ensuring that the document comply with requirements established by National Environmental Policy Act (NEPA), and the Authority is responsible for ensuring that the report comply with requirements established by the California Environmental Quality Act (CEQA).

As lead agencies, the Authority and Reclamation are responsible for establishing a liaison with the public and all federal, state, local, and tribal agencies that have jurisdiction by law or that have special expertise with respect to any environmental impact involved in a proposed action and for requesting their participation, as appropriate. The Council on Environmental Quality (CEQ) has identified areas of jurisdiction, by law or special expertise, for all federal agencies. An agency may ask the lead agencies to designate it as a cooperating agency. The lead agencies meet periodically with cooperating agencies to discuss issues and to study progress. Further discussion of the agency process is presented in section 8.4.

8.3 PUBLIC INVOLVEMENT

8.3.1 Opportunities for Public and Agency Involvement

Reclamation and the Authority have implemented a public involvement program that was design to ensure that information from the public is included and public concerns are fully addressed during the restoration effort. The overall goal of the program is to achieve consent among affected interests on a feasible solution to the problems facing the Salton Sea. The objectives of the public involvement effort include the following:

- Meet and document legal requirements for public involvement outlined in NEPA and CEQA;
- Develop public awareness and understanding about the Salton Sea Restoration Project to encourage public participate in the decision-making process;
- Provide adequate notice to interested parties about the development of a Salton Sea Restoration Project and about their opportunities to participate;
- Ensure affected local, regional, state, and federal elected and appointed officials are informed about the purpose and need for the Salton Sea Restoration Project and its progress;
- Achieve balanced decision-making that takes into account the issues important to affected interests;
- Reduce project costs by avoiding wasted effort on solutions that will not be acceptable to affected interests;
- Minimize litigation and disputes through informal negotiations; and
- Build general public understanding about the purpose and need for the project.

To date, participants representing the interests of agriculture, water districts, recreation, sport fishing, environmental organizations, businesses, and the general public have been asked to help define problems and to evaluate alternatives for solving the challenges confronting the Salton Sea area.

This public involvement has been solicited and engaged through multiple public outreach methods and activities including the following:

- Public workshops;
- Public meetings;
- Community presentations;
- Educational materials/direct mail;
- Media contacts;

- Legislative briefings;
- Project public information line/project website; and
- EIS/EIR scoping meetings.

Table 8.3-1 provides information relative to the public workshops and meetings that have been held to date on the Salton Sea Restoration Project. The public is encouraged to continue to provide input to the process by attending and participating in public workshops and by providing written comments on the draft EIS/EIR. Public involvement will continue throughout the course of completing the environmental document and implementing the project itself.

Table 8.3-1
Summary of Public Meetings

Date	Meeting Purpose
1998	
January 12	Salton Sea Symposium II, Rancho Mirage
July 15-17	Public Scoping Meetings
October 5-8	Public Alternative Screening Meetings (4)
November 2	Environmental Community Meeting, Tiburon
1999	
May 8	Congressional Task Force Hearing, Brawley
May 10	Environmental Community Meeting, Palm Desert
May 11	Alternatives Workshop, La Quinta
May 12	Alternatives Workshop, Salton City
May 12	Alternatives Workshop, Brawley
May 13	Alternatives Workshop, San Diego
May 13	Environmental Community, San Diego
November 3	Alternatives Workshop, Rancho Mirage
November 4	Alternatives Workshop, Salton City
November 4	Alternatives Workshop, El Centro
November 5	Environmental Community, Calipatria
November 8	Environmental Community, San Francisco
2000	
January 13-14	Salton Sea Symposium III, Desert Hot Springs

8.3.2 Major Public and Agency Issues and Concerns Identified During Scoping

The public scoping process has identified numerous public and agency questions and concerns. These are discussed in the Salton Sea Restoration EIS/EIR Scoping Report, published in January 1999, and posted on the Reclamation website. This document is incorporated by reference. The report includes a complete list of all comments received during the scoping period, both oral and written.

Agency comments and concerns were tracked separately and included concerns similar to those of the public. Additional concerns included the following:

- Defining the scope of the project;
- Defining the No Action Alternative; and
- Listing international boundary issues and cultural and Native American issues.

All of these issues were incorporated into the scope of the EIS/EIR analysis and, where appropriate, are addressed within the individual resource sections of this document (see Section 1.7.1 for a list of the concerns identified during public scoping).

8.3.3 Distribution of EIS/EIR

Following completion of the draft EIS/EIR, Reclamation and the Authority will distribute the document to a comprehensive list of elected officials, federal, state, regional, and local agencies, local Indian tribes, and interested organizations and individuals. In addition, the lead agencies will conduct public hearings at various locations in the project area to solicit public and agency input on the document. The availability of the document will be publicized in various media, including local and regional newspapers, the Federal Register, and the Reclamation website. All public comments on the draft EIS/EIR will be addressed in the final EIS/EIR.

8.4 Agency Coordination

In addition to activities and programs to solicit public and stakeholder involvement, a number of subcommittees and teams have been formed to ensure the involvement of all interested and participating federal and state agencies in the process. Interagency teams are important in bringing the technical expertise of the agencies into the planning process and ensuring that the appropriate agency staff are reviewing and providing recommendations at each step of the process. In many ways, the agency involvement programs have interacted with and complemented public outreach efforts.

Public agencies participating in the process to date include the following:

- California Department of Water Resources;
- International Boundary Water Commission
  - US Section
  - Mexican Section;
- US Environmental Protection Agency;
- California EPA;
- US Army Corps of Engineers;
- US Geological Survey;
- US Fish and Wildlife Service;
- Torres Martinez Band of Cahuilla Indians;
- US Bureau of Land Management;
- US Bureau of Indian Affairs;
- California Regional Water Quality Control Board;
- Coachella Valley Water District;

- Imperial Irrigation District;
- Riverside County;
- Imperial County; and
- California Department of Fish and Game.

Throughout alternative development and analysis, meetings with these cooperating agencies were conducted to allow regular consideration of their issues and suggestions. In addition, the Fish and Wildlife Service was regularly consulted directly on issues and alternative features within their expertise. EPA and the Corps of Engineers were also consulted directly relative to Section 404 and water quality issues. The Torres Martinez Band of Cahuilla Indians were individually consulted throughout the process on use of lands within and near their reservation as well as on potential effect to cultural resources related to their historic uses of the area. Table 3.16-4 includes a list of tribal organizations contacted through the Native American consultation process. The BLM was specifically consulted in relation to the use of Federal lands for project purposes. Finally, a separate meeting with State regulatory agencies was held to assure their understanding of the process and proposed alternatives.

All these agencies, and others, were consulted throughout the process informally as specific information needs and questions were identified.

8.5 RESEARCH MANAGEMENT COMMITTEE

The Secretary of the Interior, with authorization through PL 105-372, established the Research Management Committee (RMC). The RMC consists of representatives of the following entities involved in the Salton Sea recovery effort: the Department of Interior, the state of California, the Salton Sea Authority, the Torres Martinez Band of Cahuilla Indians, and the California Water Resources Center. The RMC facilitates the pooling of financial resources for research activities and coordination of research on a time-sensitive basis. The RMC acts on recommendations made by the Salton Sea Science Subcommittee relative to funding science needs and supports the awarding of science projects evaluated by the subcommittee. RMC recommendations are forwarded to the Authority for funding.

8.6 SCIENCE SUBCOMMITTEE

The Salton Sea Science Subcommittee (SSC) was established to serve as an independent and objective advisory body to provide scientific evaluations and recommendations to the RMC. The SSC is administratively responsible to the RMC. The charter for the RMC and SSC is provided on Reclamation's website at www.lc.usbr.gov. The compositions for the RMC and SSC are shown in tables 8.6-1 and 8.6-2.

The primary purpose for this science component is to provide a sound scientific foundation on which to base management judgments on various alternatives to achieve project goals. To arrive at this point, the following tasks were accomplished:

- Gathering, synthesizing, and evaluating existing scientific information relative to the Salton Sea ecosystem;

- Identifying priority data gaps and facilitating investigations for obtaining that data;
- Completing focused scientific evaluations of potential environmental impacts from proposed project alternatives and management actions; and
- Developing a strategic science plan to guide the long-term integration of science within the project.

8.6.1 Data Gathering, Synthesis, and Evaluation

There is a general perception that the Salton Sea has been "studied to death." Therefore, past and ongoing studies initially were evaluated to determine the extent and quality of information that would be useful for project evaluations. The University of Redlands is an important cooperator and collaborator in this effort. The university established an independent Salton Sea Database Program that interfaces with the science and management components of the project. The database program provides a centralized system for storing data and for processing, sharing, and distributing scientific information. The database program also has geographic information system (GIS) capabilities for mapping and evaluations. Synthesis documents were prepared for existing information by various subject matter experts, SSC subgroups, and others to address project information needs (Table 8.6-3). A wide array of documents were deposited within the University of Redlands Salton Sea Database Program for access by project managers and scientists. The database is a comprehensive collection of literature and GIS data specific to the Sea and available through the university's website, http://cem.uor.edu/.

8.6.2 Identification of Priority Data Gaps

Evaluation of existing information disclosed that much of the information was dated and of limited use because of changes taking place within the Salton Sea

Table 8.6-1
Composition of the Salton Sea Research Management Committee

Agency	Level of Appointee
Salton Sea Authority	Executive Director
State of California	Office of the Secretary
US Department of the Interior	Office of the Secretary
Torres Martinez Desert Cahuilla Indian Tribe	Tribal Chairperson
State of California University Community	Director, University of California Center for Water and Wildlife Resources

Table 8.6-2
Composition of the Salton Sea Science Subcommittee[1]

Organization Type	Representatives

Federal Agencies	US Geological Survey US Army Corps of Engineers Los Alamos National Laboratory US Environmental Protection Agency Bureau of Reclamation Bureau of Land Management US Department of Agriculture US Fish and Wildlife Service
Independent Nations	Torres Martinez Desert Cahuilla Indian Tribe
California State Agencies	Department of Fish and Game Environmental Protection Agency Department of Water Resources
Regional Agency	Salton Sea Authority
California Local Government	Riverside County Imperial County
California Water Districts	Imperial Irrigation District Coachella Valley Water District
California University Community	San Diego State University University of Redlands University of California Imperial Valley College
Environmental Groups	California Audubon Society
Mexico/United States	International Boundary and Water Commission

[1]Chaired by an Executive Director who does not represent any organization but the Science Subcommittee; all organizations are limited to one representative, except for the International Boundary and Water Commission, which has a representative from Mexico and from the United States.

Table 8.6-3
Issue-specific Reconnaissance Investigations and Synthesis Documents

Subject	Source
Synthesis Documents Followed by Reconnaissance Investigations	
The Avifauna of the Salton Sea: A Synthesis	Point Reyes Bird Observatory
Fish and Fisheries of the Salton Sea	Institute of Marine Science, University of Southern Mississippi
Chemical and Physical Analyses of the Salton Sea	Bureau of Reclamation
A Synthesis of Our Knowledge of the Biological Limnology of the Salton Sea	Center for Inland Waters and Department of Biology, San Diego State University
A Survey of Algal Toxins in the Salton Sea	Scripps Institute of Oceanography
Reconnaissance of Microbial (Bacterial and Viral) Pathogens in the Salton Sea	US Geological Survey, National Wildlife Health Center
Synthesis Document of Current Information on the Sediment, Physical Characteristics, and Contaminants at the Salton Sea, Riverside and Imperial Counties, California	Levine-Fricke Recon

Synthesis Documents	
The Potential Impact of Rising Salinity on the Salton Sea Ecosystem	Coachella Valley Water District
The Salton Sea: A Brief History and Biology[1]	Coachella Valley Water District
Avian Disease at the Salton Sea[1]	Milt Friend, Science Subcommittee
Literature Synthesis Bibliographic Reports	University of Redlands Database Program

[1] Draft documents provided for management use but not completed as final at this time.

ecosystem. Also, there have been no studies of the Sea as a whole, and the fragmented investigations that have been done do not provide sufficient data to meet some information needs. It was concluded from these evaluations that the immediate science priority was to describe the current state of the sea through a series of integrated reconnaissance studies to provide "real time" information for use in the NEPA/CEQA evaluations (Table 8.6-3). The next levels of need were determined to be an evaluation of the ecological factors resulting in major bird die-offs (Table 8.6-4), followed by evaluations of important system processes within the Sea. This information can be reviewed on the University of Redlands website (http://cem.uor.edu/). The SSC evaluated the data gaps in such a way that would satisfy the schedule requirements of NEPA/CEQA, while establishing the foundation for scientific input to long-term decisions and actions for restoring the Sea.

Table 8.6-4
Bird Mortality Investigation Awards

Area of Investigation	Awarded To
Ecology and Management of Avian Botulism at the Salton Sea	US Geological Survey – BRD – National Wildlife Health Center
Tilapia Food Habits	The University of Southern Mississippi
Identification and Ecology of Disease-Causing Agents for Eared Grebes at the Salton Sea	US Geological Survey – BRD – National Wildlife Health Center
Identification of Natural Toxins at the Salton Sea	University of California at San Diego Scripps Institute of Oceanography
Investigations of the Cause of Eared-Grebe Mortality at the Salton Sea – Algal Blooms and Biotoxins	Wright State University

Science investigations are competitively awarded by the Salton Sea Authority. Requests for proposals to address specific needs are developed by the SSC, are broadly advertised, and are available on Reclamation's website (www.lc.usbr.gov). Proposals received are evaluated initially by the SSC for relevance and general scientific merit. Proposals deemed to be of value are then submitted for external peer review by subject matter experts. Peer review is the dominant factor regarding which proposals are selected for funding. Successful proposals have originated from the private sector, university community, and government agencies.

Findings from these studies provide important information of direct relevance for evaluations of proposed management actions. Findings often differ from popular perceptions and conventional wisdom about the Sea based on earlier investigations and more fragmented scientific efforts.

8.6.3 Focused Scientific Evaluations for Potential Environmental Impacts

The SSC independently evaluates proposed management actions, including the No-Action Alternative. These evaluations are restricted to the potential biological impacts, both positive and negative, likely to occur as a result of the actions being considered. Subject matter experts are invited to SSC meetings to assist with evaluations. Evaluations are restricted to actions being considered by management, as it is not an SSC role to propose actions. Findings are nonjudgmental regarding acceptance or rejection of proposed actions; instead, they focus on highlighting probable environmental outcomes associated with the proposed actions. Those outcomes are considered by the project co-lead agencies in making decisions on alternatives being considered. Evaluations are provided orally in some instances and as formal reports of the SSC in other instances.

8.6.4 Strategic Science Plan

It is recognized that restoration of the Salton Sea requires a long-term effort, that science needs for the immediate NEPA/CEQA evaluations differ somewhat from the long-term needs, and that a phased approach is needed for the science effort. A Strategic Science Plan (SSP) to guide the long-term integration of science within the project is described as a common action in Section 2.6.8 and is discussed further in a companion document to this NEPA/CEQA evaluation. The SSP builds upon the foundation provided by the SSC process and provides a blueprint for the science process, functions, and administrative structure, which are needed to sustain a long-term science component of the adaptive management approach.

8.7 SALTON SEA RESTORATION WORKGROUPS AND ADVISORY TEAMS

In addition to the agencies and committees discussed above, several Salton Sea restoration workgroups and advisory teams have been established to assist in the restoration project effort. These groups include the Economic Development Task Force, formed by the Authority to investigate economic opportunities associated with restoration of the Sea, and the Alternatives Enhancement Subgroup, formed to address project goals and objectives.

CHAPTER 9
REGULATORY REQUIREMENTS AND MITIGATION

Construction and operation of the Salton Sea Restoration Project would be subject to a variety of regulatory standards that are in place to safeguard the human environment. Many of these regulatory standards would require the lead agencies to obtain applicable permits. In addition, a mitigation monitoring and reporting program would be implemented to ensure that the permit requirements are satisfied, that restoration actions are performing as expected, and that mitigation measures are applied appropriately. The following sections describe the regulatory requirements, the permits required, and the mitigation monitoring and reporting program.

9.1 REGULATORY FRAMEWORK

The Salton Sea Restoration Project will operate within the framework of a number of regulations designed to protect the environment. The most important of those regulatory requirements are summarized below.

9.1.1 Water Quality Standards

Several federal and state laws, regulations, and policies are applicable to this project. The Clean Water Act, the California Water Code, the California Code of Regulations, the U.S. Code of Federal Regulations (specifically, 40 CFR Subchapter D); State Water Resources Control Board (SWRCB) Policies, and the Water Quality Control Plan for the Colorado River Basin Region are applicable federal and state laws, regulations and policies associated with water quality. These laws and regulations apply in their entirety. The following selected rules and regulations generally relate to discharges to receiving waters. They are designed to protect environmental, agricultural, municipal, industrial, and recreation uses of water. The major federal and state regulations and sections specifically associated with this project and water quality are discussed below.

Clean Water Act—Section 303(d). Section 303(d) of the Clean Water Act (CWA) requires that each state develop a list, known as a 303(d) list, of waterbodies whose water quality is impaired. The 303(d) list for each state identifies impaired waterbodies and sources of impairment, such as mine drainage, agricultural drainage, urban and industrial runoff, and municipal and industrial wastewater discharges. In 1996, the state of California identified approximately 90 impaired waterbodies in its 303(d) list. The Salton Sea and its tributaries, the New and Alamo rivers, are included on the 303(d) list. The 303(d) compliance process involves establishing TMDLs for listed water quality parameters. A work group has been established, separate from the Salton Sea Restoration Project, to develop and implement strategies for TMDL compliance at the Sea and its tributaries.

Federal Guidance on Water Quality Criteria for Toxic Pollutants. The USEPA has developed National Guidance on Water Quality Criteria (CWA Section 304[a]) for pollutants to protect human health and aquatic life. Relevant pollutants are identified under Section 307 of the CWA. The states used these criteria to develop the now defunct 1991 Inland Surface Water Rule. An update to the National Guidance document, the National Toxics Rule, was promulgated in 1992. California was included in the rule for parameters that were not addressed in the Inland Surface Water Rule. Currently, the USEPA is developing a California Toxics Rule to address parameters not covered for California in the original National Toxics Rule. The California Toxics Rule will be an update of the national rule, based on best currently available scientific data. Decisions regarding site-specific conditions will be deferred to the state RWQCBs.

Porter-Cologne Act. In 1967, the Porter-Cologne Act established the State Water Resources Control Board (SWRCB) and nine regional boards as the state agencies with primary authority over the regulation of water quality and allocation of appropriative surface water rights in California. The Porter-Cologne Act is the primary state water quality legislation administered by SWRCB and requires regional boards to formulate and adopt water quality control plans (basin plans) that are reviewed and revised periodically. The nine regional water quality control boards (RWQCBs) implement Porter-Cologne, the CWA, SWRCB policies, and their Basin Plans in their respective Regions. Basin plans designate beneficial uses for specific surface water and ground water resources and establish water quality objectives to protect those uses. To ensure that water quality objectives are met, SWRCB issues water right permits, and RWQCBs issue waste discharge requirements for the major point-source waste dischargers, such as municipal wastewater treatment plants and industrial facilities.

The SWRCB enacted the Enclosed Bays and Estuary Plan (EBEP) and the Inland Surface Waters Plan (ISWP), which set numeric and narrative criteria for toxic metals and organic compounds. Litigation brought against the plans in 1994 resulted in their revocation, and they are currently under review for readoption. Since that time, California has not been in compliance with Section 303(c)(2)(B) of the Clean Water Act (CWA). This section, which was amended to the CWA in 1987, required the states to adopt water quality criteria for all CWA Section 307(a) priority toxic pollutants (priority pollutants) that could interfere with the designated uses of the State's waters and for which the USEPA has published criteria guidance under CWA Section 304. The rescinded ISWP and EBEP included water quality objectives (which are equivalent to federal water quality criteria) for the majority of the priority pollutants.

To bring California into compliance with Section 303(c)(2)(B), the USEPA is proposing to promulgate the California Toxics Rule (CTR). The CTR will establish water quality criteria for priority pollutants that were not previously promulgated for California in U.S. EPA's National Toxics Rule, promulgated on December 22, 1992 (57 Federal Register 60848-60923) and amended on May 4, 1995 (60 FR 22228-22237). The SWRCB and the RWQCBs also implement sections of the federal CWA, administered by the USEPA through the SWRCB and RWQCBs, including the National Pollutant Discharge Elimination System (NPDES) permitting process for all point sources and for certain nonpoint source waste discharges. The RWQCBs can adopt and enforce requirements on any proposed or existing waste discharge, including discharges from point and nonpoint sources.

Concurrently, the SWRCB is coordinating its activities with the CTR by developing the ISWP and EBEP in two phases. Phase 1 entails the development and adoption of the proposed Policy. Phase 2 will involve incorporating the policy provisions, together with State-adopted water quality objectives, into a new ISWP and EBEP.

Both numerical and narrative water quality objectives are established to protect beneficial uses. Water quality objectives are established to protect beneficial uses, including human health and aquatic life. Once approved by the USEPA, the objectives become enforceable under both the CWA and Porter-Cologne.

Water Quality Control Plan for the Colorado River Basin Region. The Water Quality Control Plan for the Colorado River Basin Region and applicable statewide plans serve as California's Water Quality Management Plan governing waterbodies in the Colorado River Basin Region. The Plan contains the designated beneficial uses and water quality objectives that apply to the waters of the Region.

9.1.2 Water Rights

Two basic types of water rights characterize water use in California: riparian water rights and appropriative water rights. Riparian water rights are based on ownership of land adjacent to a waterbody, while appropriative water rights are based on the principle of "first in line, first in right."

Riparian water rights are not lost if unused and are not quantified. Landowners with these rights can divert portions of a waterbody's natural waterflow for reasonable and beneficial use on their land, provided the land is within the same watershed as the waterbody. During times of water shortage, all riparian water rights holders must share the available supply according to each landowner's reasonable requirements and uses (California State Water Resources Control Board 1989). Appropriative water rights account for the vast majority of water rights in California. These rights are based on the concept that the first to claim and beneficially use a specific amount of water has a superior claim to later appropriators.

Appropriative rights are quantified and may be lost if unused. Appropriative water rights issued after 1914 are under the jurisdiction of the SWRCB. All water users existing in 1914 were assigned the same seniority. The SWRCB issues appropriative rights with conditions to protect other water rights holders, including delta and upstream riparian water users, and to protect the public interest, including fish and wildlife resources. The quantity and quality of water used by existing riparian and senior appropriative users must not be impaired by subsequent appropriative water rights.

9.1.3 Biological Resources Protection

Biological resources within California are protected by both the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA), which are described below.

Federal Endangered Species Act. Section 7 of the ESA of 1973, as amended, requires federal agencies, in consultation with the USFWS, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. Salton Sea Restoration Project Phase 1 actions will require consultation under Section 7 of the ESA. In general, this consultation will include specification of incidental "take" limits for any special category species that may be adversely affected by the project. "Take," as defined in the ESA, includes harassment of and harm to a species, directly and indirectly caused mortality, and actions that adversely modify habitat. Reclamation is preparing a biological assessment (BA) to address potential species of concern affected by Phase 1 Alternatives. This BA will be submitted to the USFWS for review and concurrence; a BA for Phase 2 alternatives will be prepared at a later date. Following acceptance of the BA, the USFWS and the National Marine Fisheries Service (NMFS) will prepare separate biological opinions.

The Phase 2 alternatives will be subjected to more programmatic environmental review than Phase 1 actions, reconnaissance-level analysis, and feasibility-level planning. The broad analysis of Phase 2 alternatives will be followed by project-specific analyses in supplemental documents. This approach also will ensure ESA compliance for Phase 2 actions that affect listed species.

California Endangered Species Act. CESA requires an agency, when acting as a lead agency for purposes of complying with CEQA, to consult with the CDFG. This consultation will ensure that its action does not jeopardize the continued existence of a species listed as endangered or threatened under CESA. The CDFG uses information in draft environmental documents, such as an EIR, to issue a biological opinion on whether the action would jeopardize the continued existence of any state-listed species affected by the proposed alternatives. CESA requires that when an action affects a species listed under both CESA and ESA and the project is subject to state lead agency and federal agency action, the CDFG must request and participate in the federal consultation to the greatest extent practicable. CDFG, as a participant in the consultation process for the Salton Sea Restoration Project, may adopt the federal biological opinion as written findings of its biological opinion for the EIS/EIR.

9.1.4 Air Quality Standards

The purpose of the Clean Air Act (CAA) is to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population. The CAA requires that any federal action be evaluated to determine its potential impact on the quality of the air in the project region. Specifically, the federal agency must make a conformity determination. California has a corresponding law that must be considered during the EIR process.

Pursuant to the requirements of Section 176 of the CAA (42 USC Section 7506[c]), federal agencies are prohibited from engaging in or supporting in any way an action or activity that does not conform to an applicable state implementation plan. Conforming to an implementation plan means conforming to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and expeditiously attaining such standards. USEPA has promulgated conformity regulations (codified in 40 CFR Section 93.150 et seq.) This EIS/EIR includes a conformity analysis of the Salton Sea Restoration Project Phase 1 alternatives. A more general discussion is provided for air quality issues associated with Phase 2 actions, with more specifics to be provided in subsequent supplemental documents.

9.1.5 Cultural Resource Protection

Cultural resources are defined broadly as archaeological and architectural resources, Native American resources, and paleontological resources. Archaeological, architectural, and Native American resources are protected through federal and state laws; paleontological resources are protected indirectly through various laws.

Archaeological and Architectural Resources. Cultural resources are protected primarily through the National Historic Preservation Act (NHPA) of 1966 and its implementing regulation, Protection of Historic Properties (36 CFR § 800), the Archaeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1979, and CEQA. Section 106 of the NHPA (16 USC 470-470w6), as amended (PL 89-515), requires federal agencies to consider the effects of their actions on properties that are listed in or eligible for listing in the National Register of Historic Places (NRHP).

The implementing regulations of the NHPA require federal agencies to provide the State Historic Preservation Officer (SHPO) with an opportunity to comment on any actions that may affect a historic property and to provide the Advisory Council on Historic Preservation (ACHP) with an opportunity to comment on any action that will adversely affect a historic property.

CEQA requires state agencies to consider the effects of their actions on historically significant resources, which are those that meet the criteria for listing in the California Register of Historical Resources (CRHR) or a local register of historical resources. Criteria for inclusion in the CRHR are provided in Section 15064.5 of CEQA and are similar to the criteria for inclusion in the NRHP, described above.

Native American Resources. Section 101(d)(6)(A) of the NHPA allows properties of traditional religious and cultural importance to a tribe to be determined eligible for inclusion in the NRHP. The American Indian Religious Freedom Act of 1978 also allows for access to sites of religious importance to Native Americans. The Native American Graves Protection and Repatriation Act of 1990 provides for the repatriation of human remains and funerary items to identified Native American descendants. Appendix K of CEQA also contains provisions for the discovery of human remains that are of Native American origin.

Paleontological Resources. While there are no federal or state laws directly pertaining to paleontological resources, several laws include such resources within their scope. Federal agencies are required under NEPA to protect all historical, cultural, and natural aspects of the environment. The Federal Land Policy Management Act of 1976 (FLPMA) specifies that public lands should be managed in a manner that protects the quality of scientific resources. Also, CEQA requires state agencies to consider the effects of their projects on all aspects of the physical conditions that exist within the area affected by the proposed project, including paleontological resources. Appendix G of CEQA states that a project may be deemed to have a significant effect on the environment if it will disrupt or adversely affect a paleontological site, except as part of a scientific study.

The BLM considers all vertebrate and some scientifically important invertebrate species to be significant nonrenewable resources (Cunkelman 1999). Fossil resources on BLM land are regulated by three statutes (FLPMA, Federal Caves Resources Protection Act of 1988, and Crimes and Criminal Procedures 18 USC 641) and ten regulations. Permits are required for collecting or disturbing vertebrate fossils on BLM land.

Reclamation must adhere to statutes (18 USC 641, PL 100-691) that prohibit collecting fossils or destroying cave resources. Secretarial Order 3104 grants Reclamation the authority to issue paleontological resource use permits for lands under its jurisdiction.

9.1.6 Indian Trust Assets

The Department of the Interior Order No. 3175 requires all its bureaus and offices to explicitly address anticipated effects on Indian Trust Assets in planning, decision, and operation documents. On July 2, 1993, Reclamation adopted the Indian Trust Asset Policy, which states that Reclamation would seek to protect or avoid adverse impacts to Indian Trust Assets. When adverse impacts cannot be avoided, Reclamation will provide for an appropriate mitigation or compensation. This policy also states that Reclamation will not engage in a taking of Indian Trust Assets without statutory authority and adequate compensation.

Reclamation policy (BOR 1994) advises that a NEPA document must state clearly the United States' position when a resource in question is not considered an Indian Trust Asset. If disputed by an Indian group, the group's position also must be clearly outlined.

9.1.7 Public Trust Doctrine

California has an affirmative duty to take the public trust into account in planning and allocating water resources and to preserve, so far as is consistent with the public interest, the uses protected by the trust. In common law, the public trust doctrine protected navigation, commerce, and fishery uses in navigable waterways. However, the courts have expanded the application of the doctrine to apply to protection of tidelands, wildlife, recreation, and other public trust resources in their natural state for recreational, ecological, and habitat purposes as they affect birds and marine life in navigable waters. In the National Audubon Society v. Superior Court case (1983), the California Supreme Court ruled that in administering water rights laws and approving water diversions, the state also has a duty to continuously supervise the taking and use of appropriated water to protect these public trust uses.

9.2 Project Approval Requirements

A number of laws and regulations apply to the project that would require permit preparation, review and approval actions. Table 9-1 provides a summary of potential permit and approval requirements from applicable federal, state, and local agencies. Table 9-2 indicates which specific permits and what approval may be required for each project feature.

9.3 Mitigation Monitoring and Reporting Plan

The mitigation monitoring and reporting plan would be part of the overall long-term science and management plans for the Sea. The long-term science plan would include conceptual modeling, long-term monitoring, quantitative modeling, focused investigations, technical assistance, and data management. The conceptual modeling would guide both long-term monitoring and focused studies toward

Table 9-1
Salton Sea Restoration Project Approval Requirements

Agency	Permit/Approval	Authority
US Army Corps of Engineers	River and Harbors Appropriation Act, sections 9 and 10, permit for construction in navigable waters	33 USC §§ 401, 403; 33 CFR Parts 320, 322, and 325
US Army Corps of Engineers	Section 404 of the Clean Water Act permit	33 USC § 1344
US Environmental Protection Agency	Project review	
US Fish and Wildlife Service	Interagency consultation pursuant to § 7 of the Endangered Species Act	Endangered Species Act, 16 USC §§ 1531 et seq.; 50 CFR Part 402
US National Marine Fisheries Service	Interagency consultation pursuant to § 7 of the Endangered Species Act	Endangered Species Act, 16 USC §§ 1531 et seq.; 50 CFR Part 402
US National Oceanic and Atmospheric Administration (Monterey Bay National Marine Sanctuary)	Endangered Species Act and National Marine Sanctuaries Act consultation	Endangered Species Act, 16 USC §§ 1531 et seq.; 50 CFR Part 402
Advisory Council on Historic Preservation	Interagency consultation pursuant to Section 106 of the National Historic	NHPA; 36 CFR § 800

Agency	Permit/Approval	Authority
	Preservation Act (NHPA)	
Bureau of Land Management	Section 106 consultation and concurrence (for projects on BLM land).	NHPA; 36 CFR § 800
California Coastal Commission	Coastal zone development permit and federal coastal consistency determination	California Coastal Act of 1976, Cal. Pub. Res. Code §§ 30000 et seq.; Federal Coastal Zone Management Act, 16 USC §§ 1451-1465
California State Historic Preservation Officer	Interagency consultation pursuant to Section 106 of NHPA	NHPA; 36 CFR § 800; CEQA
Colorado River Basin Regional Water Quality Control Board	Point source NPDES permit	State Porter-Cologne Water Quality Control Act, Cal. Water Code §§ 13370-13389, Federal Clean Water Act, 42 USC §§ 1251-1389
Colorado Region Regional Water Quality Control Board	Clean Water Act Section 401 compliance (water quality certification); Waste Discharge Requirements	State Porter-Cologne Water Quality Control Act, Cal. Water Code §§ 13000-14958, Federal Clean Water Act, 33 USC §§ 1251-1387; Title 27, Cal Code of Regulations and 40 CFR 258.1
California State Water Resources Control Board	Appropriated water permits	
Imperial County Air Pollution Control District and South Coast Air Quality Management District	Air pollution control permit	Cal. Health & Safety Code §§ 40918-40926; Federal Clean Air Act 42 USC §§ 7401-7642
Imperial County Air Pollution Control District and South Coast Air Quality Management District	Permit to construct	Cal. Health & Safety Code §§ 40501.2-40719; Federal Clean Air Act 42 USC §§ 7401-7642

Table 9-1
Salton Sea Restoration Project Approval Requirements *(continued)*

Agency	Permit/Approval	Authority
California State Lands Commission	Sate Lands Commission dredging permit	Cal. Pub. Res. Code §§ 6000 et seq.; Title 14, Cal. Regs. §§ 1900 et seq.
California State Lands Commission	Land use lease	Cal. Pub. Res. Code §§ 6000 et seq.; Title 14, Cal. Regs. §§ 1900 et seq.
California Department of Fish and Game	Interagency consultation	California Endangered Species Act, Cal. Fish & Game Code §§ 2090 et seq.; Cal. Fish & Game Code § 1603
California Department of Fish and Game	Lake and streambed alteration permit	Title 14, Cal. Regs. §§ 1600-1607
California Department of Fish and Game	Department of Fish and Game dredging permit	Cal. Regs. §§ 228
Department of Parks and Recreation	Encroachment permit	Cal. Pub. Res. Code §§ 5012
California Department of Transportation	Encroachment permit for use of state rights-of-way	California Streets and Highways Code § 1460
County of San Diego	Coastal development permit Consistency with San Diego County's local coastal program Grading permit Encroachment permit for use of county rights-of-way	California Coastal Act of 1976, Cal. Pub. Res. Code §§ 30000 et seq.
Counties of Imperial and Riverside	EIR certification	CEQA, Cal. Pub. Res. Code §§ 21000-21178.1
Native American tribal groups	Consultation for projects on tribal land	NHPA; 36 CFR § 800; native American Graves Protection and Repatriation Act; American Indian Religious Freedom Act; Department of Interior Order No. 3175

goals and objectives identified for the project. Monitoring would be implemented to evaluate the success of restoration actions and to collect long-term data from which quantitative models can be validated. Quantitative modeling would be used to generate hypotheses about these processes and ecosystem functions that focused investigations then would explore. Focused investigations would fill in key information gaps, would support monitoring by identifying important measures that were not initially recognized, and also would help in validating quantitative models. Technical assistance would involve time-responsive short-term needs, such as consultations, data synthesis and evaluation, and other scientific evaluations to guide management response and actions. The data management program that would facilitate integration of data among monitoring, focused investigations, modeling, and management is also an essential component of the science effort. This program is expected to be environmentally beneficial in that it would allow managers to adapt restoration actions to future ecological needs. The long-term science program, including the monitoring components, is discussed in more detail in Section 2.6.8 of Chapter 2 of the EIS/EIR.

Table 9-2
Potential Permitting Requirements

Permits		404 Permit	Endangered Species Act	Habitat Conservation Plan	Point Source NPDES Permit	401 Certification	Appropriated Water Permit	Air Pollution Control Permit	State Lands Encroachment Permit	State Lands Dredging Permit	Streambed Alteration Permit	DFG Dredging Permit	Department Of Parks Encroachment	CalTrans Encroachment	County Permits
Phase One - Alternatives	Concentration ponds SW Shore	X	X	X	X	X	X	X	X	X					
	EES former Salton Sea Test Base		X	X				X			X			X	
	EES - Bombay Beach		X	X				X			X			X	
	Concentration ponds and EES	X	X	X	X	X	X	X	X	X	X			X	
Phase One - Common Actions	Fish harvesting		X	X											
	Improved recreational facilities	X	X	X		X			X	X					X
	Floods flows via existing or new facilities	X	X	X	X	X	X		X		X				
	Shoreline cleanup		X	X									X		X
	Integrated wildlife disease control and long-term management programs														
Phase One - Conditional Actions	Perimeter pupfish channel	X				X			X	X					
	Nesting/roosting structures														
	Sustain fishery (dike system/fishing programs)	X			X	X			X	X	X				
Phase Two - Alternatives	Export to expanded EES		X	X							X				
	Export to the Gulf of California	X	X	X	X	X	X		X	X	X			X	X
	Export to the Pacific	X	X	X	X	X	X		X	X	X		X	X	X
	Export to Danby	X	X	X	X	X	X		X	X	X			X	X
	Import through Yuma, AZ	X	X	X	X	X	X		X	X	X			X	X
	Import from San Diego Water Treatment Plant	X	X	X	X	X	X		X	X	X		X	X	X
Phase Two - Conditional Actions	Wetlands and/or sediment traps	X	X	X	X	X	X		X						
	Soil stabilization measures		X	X	X	X	X		X						

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CHAPTER 11
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CHAPTER 12
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A

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CHAPTER 13
GLOSSARY

Acute toxicity	A biologically hazardous effect marked by sudden severe onset following exposure.
Advisory Council on Historic Preservation (ACHP)	A 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological resources, and to perform other duties as required by law (Public Law 89-655; 16 USC 470).
Alluvial soil	Soil developed on clay, silt, sand, and gravel sediments deposited by running water.
Ambient air quality standards	Standards established on state or federal level that define the limits for airborne concentrations of designated criteria pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, lead, particulate matter) to protect public health with an adequate margin of safety (primary standards) and public welfare, including plant and animal life, visibility, and materials (secondary standards).
American Indian Religious Freedom Act (AIRFA)	AIRFA establishes as US policy the protection of the rights of American Indians to practice their traditional religions, including "access to sites, possession of sacred objects, and freedom to worship through ceremonies and traditional rites" (42 USC 1996).
Anaerobic	Living, active, or occurring in the absence of oxygen.
Anoxic zone	An area without oxygen.
Apportionment	An amount of water to which one is legally entitled.
Aquifer	A porous geologic unit capable of yielding significant quantities of water to a well.
Archaeological site	Any location where humans have altered the terrain or discarded artifacts. The location of past cultural activity; a defined space with more or less continuous archaeological evidence.
Archaeology	A scientific approach to the study of human ecology, cultural history, and cultural process, emphasizing systematic interpretation of material remains.

Artesian groundwater system	Water under pressure in a confined aquifer, such that the water will rise above the elevation of the confining layer in a well.
Attainment area	An area that meets the National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act or that meets state air quality standards.
Benthic	Benthic habitats and organisms occur or are located at the bottom of water bodies.
Bioaccumulation	The increasing concentration of a compound in the tissues of organisms as the compound passes along a food chain, resulting from the accumulation of the compound at each trophic level prior to its consumption by organisms at the next trophic level.
Bioenergetics	The biology of energy transformations and energy exchanges within and between living organisms and their environments.
Brackish	Saline water with a salt concentration between freshwater and seawater.
Carcinogen	A substance that induces cancer in living tissue.
Channelize	To confine a waterway to a clearly defined bed, usually significantly narrower and often straighter than the previous route.
Chronic toxicity	A biologically hazardous effect that makes itself known over a long period of time following exposure.
Clean Air Act (CAA)	The CAA legislates that air quality standards set by federal, state, and county regulatory agencies establish maximum allowable emission rates and pollutant concentrations for sources of air pollution on federal and private property. Also regulated under this law is proper removal and safe disposal of asbestos from buildings other than schools.
Clean Air Act conformity	The requirement that federal agency actions in nonattainment or maintenance areas be consistent with the Clean Air Act and with federally enforceable air quality management plans.
Clean Water Act of 1972, 1987 (CWA)	The CWA is the major federal legislation for improving the nation's water resources. It provides for development of municipal and industrial wastewater treatment standards and a permitting system to control wastewater discharges to surface waters. The act contains specific provisions for regulating ships' wastewater and for disposing of dredge spoils within navigable waters. Section 404 of the act regulates disposal into "Waters of the United States," including wetlands.
CNEL	Community Noise Equivalent Levels: a method of measuring noise levels by averaging noise levels measured over a 24-hour period, weighted for sensitive times such as nights and evenings.
Consumptive use	A use of water that does not result in the water returning to the waterway, such as irrigation water taken up by plants, water used in manufacturing processes, or water used household uses.
Council on Environmental Quality (CEQ)	Established by NEPA, the CEQ consists of three members appointed by the President. CEQ regulations (40 CFR 1500-1508, as of July 1, 1986) describe the process for implementing NEPA, including preparation of environmental assessments and environmental impact statements and timing and extent of public participation.

Criteria pollutants	The CAA required the EPA to set air quality standards for common and widespread pollutants after preparing criteria documents summarizing scientific knowledge on their health effects. Today there are standards for six criteria pollutants: sulfer dioxide, carbon monoxide, particulate matter less than 10 microns in diameter (PM_{10}), nitrogen dioxide, ozone, and lead.
Cultural resources	Prehistoric and historic districts, sites, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or a community for scientific, traditional, religious, or any other reason. Native American resources are sites, areas, and materials important to Native Americans for religious or heritage reasons. Resources may include prehistoric sites and artifacts, contemporary sacred areas, traditional use areas (e.g., native plant habitat), and sources for materials used in the production of sacred objects and traditional implements.
de minimus levels	Amounts of pollutants that are below the legal minimum levels and therefore not subject to regulation.
Dispersion model	A mathematical description of the spread of air or water constituents.
Dissolved oxygen	Amount of oxygen held within water. Monitoring the amount of oxygen dissolved in water is one measure of water quality. The maximum amount of oxygen that can be dissolved in water varies with the temperature of the water and the pressure of the atmosphere.
Endangered species	A species that is threatened with extinction throughout all or a significant portion of its range.
Endangered Species Act (ESA)	An act of Congress of 1972; 16 U.S.C. 1531-1543. The act requires federal agencies to ensure that their actions do not jeopardize the existence of endangered or threatened species.
Enhanced Evaporation System (EES)	A method to reduce the salinity of the Salton Sea. Water is sprayed at a sufficient height for the water to evaporate and the salts to precipitate and collect in a catchment basin. The collected salts would be disposed of in a landfill.
Eutrophic	A condition in which a body of water is enriched with dissolved nutrients that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen.
Evapotranspiration	Loss of water to the atmosphere from soil and vegetation by evaporation and transpiration.
Fault	A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred.
Geology	The science that deals with earth; the materials, processes, environments, and history of the planet, including the rocks and their formation and structure.
Geothermal	Relating to or using the heat of the earth's interior.
Groundwater	Water present in porous geologic materials beneath Earth's surface.
Gyre	A large rotational current.

Hydrology	The science dealing with the study of water, including the properties, distribution, and circulation of water in natural systems.
Igneous rock	Rock formed by the solidification of magma, or lava.
Incinerator	A furnace for the destruction and/or breakdown of waste materials by burning.
Ionizing radiation	Radiation that causes the release of free electrons
KGRA	Known geothermal resource areas
Leach	The removal of soluble constituents from porous materials by percolating water.
Life cycle	The stages through which an organism passes during development from a fertilized egg to reproduction to death.
Liquefaction	Phenomenon in which a sudden increase in pressure, caused by an earthquake, causes loose, cohesionless, water-saturated soils or sediments to undergo temporary but complete loss of shear strength, such that the soil resembles a liquid.
Mean	The average value of items in a sample.
Metamorphic rock	Rock transformed by temperature and/or pressure.
Mouth brooder	Refers to a species in which the females carry the eggs and young fry in their mouths.
Mutagen	A substance which induces a change or mutation in the genetic material of a living organism.
National Environmental Policy Act (NEPA)	Public Law 91-190, passed by Congress in 1969, established a national policy designed to encourage consideration of the influence of human activities on the natural environment. NEPA also established the Council on Environmental Quality. NEPA procedures require that environmental information be made available to the public before decisions are made.
National Historic Preservation Act (NHPA)	The NHPA protects cultural resources. Section 106 of the act requires a federal agency to take into account the potential effect of a proposed action on properties listed on or eligible for listing on the National Register of Historic Places.
National Register of Historic Places (NRHP)	A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under the authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.
Native American Graves Protection and Repatriation Act (NAGPRA)	NAGPRA defines the ownership and control of Native American human remains and associated funerary objects discovered or recovered from federal or tribal land.
Native Americans	Used in the collective sense to refer to individuals, bands, or tribes who trace their ancestry to indigenous populations of North America prior to Euro-American contacts.
Oxidation-reduction	A chemical reaction in which one or more electrons are transferred from one atom or molecule to another.

Passerines	Song birds
Pathogen	A specific causative agent (such as a bacterium or virus) of disease.
Percolation	The downward movement of water through soil.
Permeability	In geology, the ability of rock or soils to transmit a fluid.
Porter-Cologne Water Quality Control Act	California statute that established the State Water Resources Control Board to coordinate activities dealing with water rights, water pollution, and water quality.
Recharge	Replenishment of water to an aquifer.
Salinity	The concentration of salts in a liquid commonly measured in milligrams per liter (mg/L) or parts per thousand (ppt).
Seismic	Pertaining to any earth vibration, especially an earthquake.
Seismicity	Relative frequency and distribution of earthquakes.
Semi-volatile organics	Organic compounds with relatively low vapor pressure at room temperature and normal atmospheric conditions. Refers to a class of compounds that can be extracted under atmospheric conditions without loss from volatilization.
Soil reactivity	The acidity or alkalinity of a soil. Highly reactive soils may be incompatible with certain materials, such as steel tanks or concrete foundations.
Soluble	Ability to dissolve in a liquid.
Stakeholder	Individual, organization, or government agency that manages, owns, or depends upon resources that may be affected by a proposed project.
Standard deviation	A measure of the variability among items in a sample.
State Historic Preservation Officer (SHPO)	The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for implementing the National Historic Preservation Act.
Stochastic	Stochastic models depict processes that are influenced by factors with random values. For example, the salinity and elevation of the Salton Sea depends upon the quality and quantity of water inflows, which will vary over time. The water-budget accounting model predicts salinity and elevation resulting from the variable inflows by a random or probabilistic distribution. Stochastic models are typically used when the underlying mechanisms are not well known but appear to occur randomly. Many water resource problems require stochastic analysis because they are driven by meteorological events.
Stratification	Refers to a layered distribution. For example, depending upon the circulation patterns in the Salton Sea, inflows will form a layer of freshwater on top of more saline water.
Surface water	Water on earth's surface, as distinguished from water in the ground (groundwater).

Trophic levels	Energy stored by plants moves through the ecosystem as it is consumed and utilized at various levels in the food chain. The trophic levels are producer (plant), primary consumer (herbivore), secondary consumer (primary carnivore), and tertiary consumer (secondary carnivore).
Turbidity	A measure of the collective optical properties of a water sample that cause light to be scattered and absorbed rather than transmitted in straight lines. Turbidity measures the scattering effect that suspended solids have on light: the higher the intensity of scattered light, the higher the turbidity. Primary contributors to turbidity include clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton, and microscopic organisms. In surface water, the clarity of a natural body of water is used routinely as an indicator of the condition and productivity of the aqueous system.
UN-designated biosphere	In 1968, the UNESCO Conference on the Conservation and Rational Use of the Biosphere held a meeting, which led to the launch of the Man and the Biosphere (MAB) Program. The Biosphere Reserve concept was a key component for achieving MAB's objective to strike a balance between the apparently conflicting goals of conserving biodiversity, promoting economic and social development and maintaining associated cultural values. Biosphere Reserves were conceived as sites where this objective was to be tested, refined, demonstrated and implemented. The northern portion of the Gulf of California has been designated as one of these biosphere reserves.
US Environmental Protection Agency (EPA)	The independent federal agency established in 1970 to regulate federal environmental matters and to oversee the implementation of federal environmental laws.
Vector	An organism (such as an insect) that transmits a pathogen.
Water entitlement	The legal right to water.

APPENDIX A
RESTORATION ALTERNATIVE SCHEMATICS

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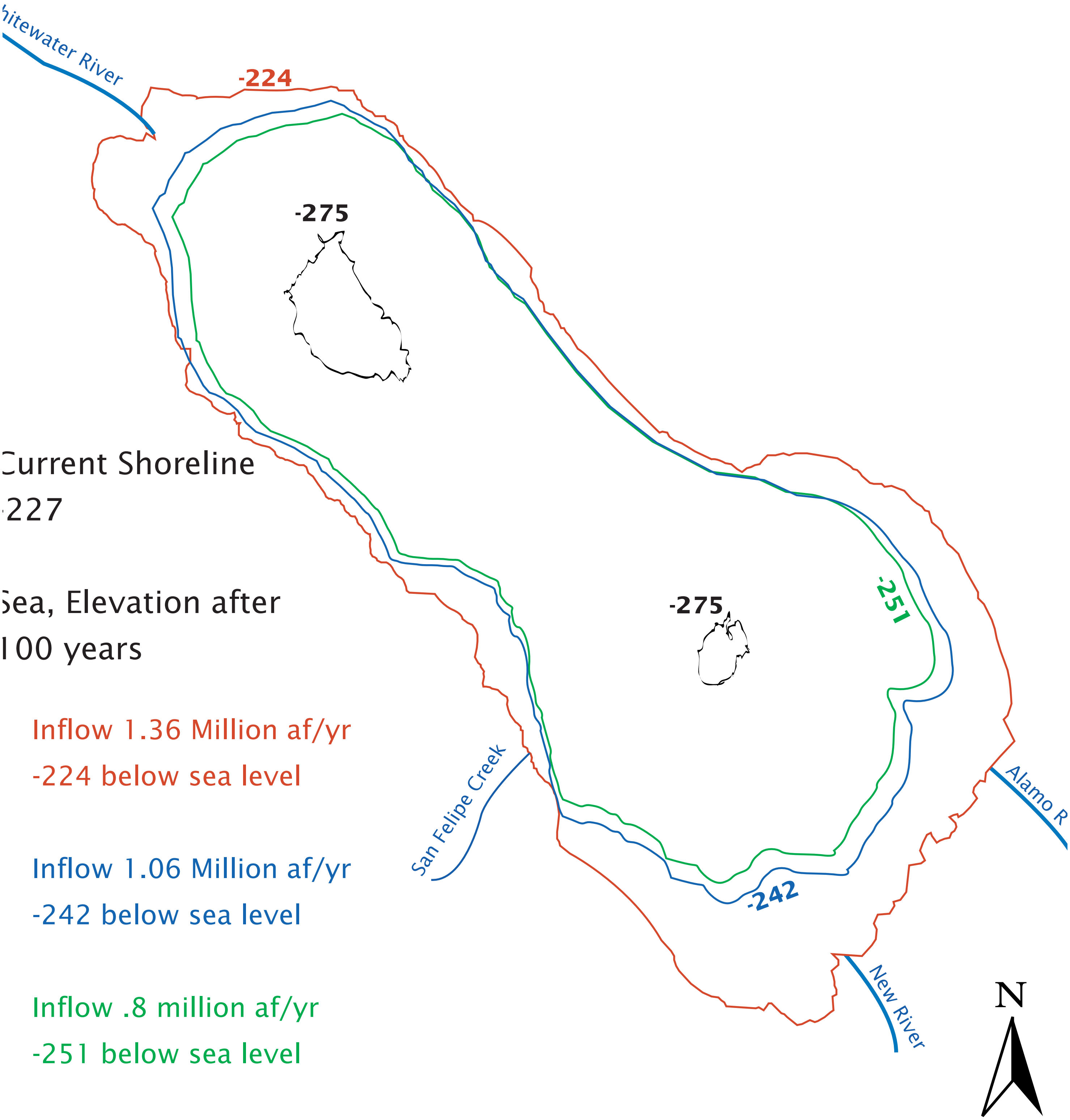
No Action



Current Shoreline
-227

Sea, Elevation after
100 years

Inflow 1.36 Million af/yr
-224 below sea level

Inflow 1.06 Million af/yr
-242 below sea level

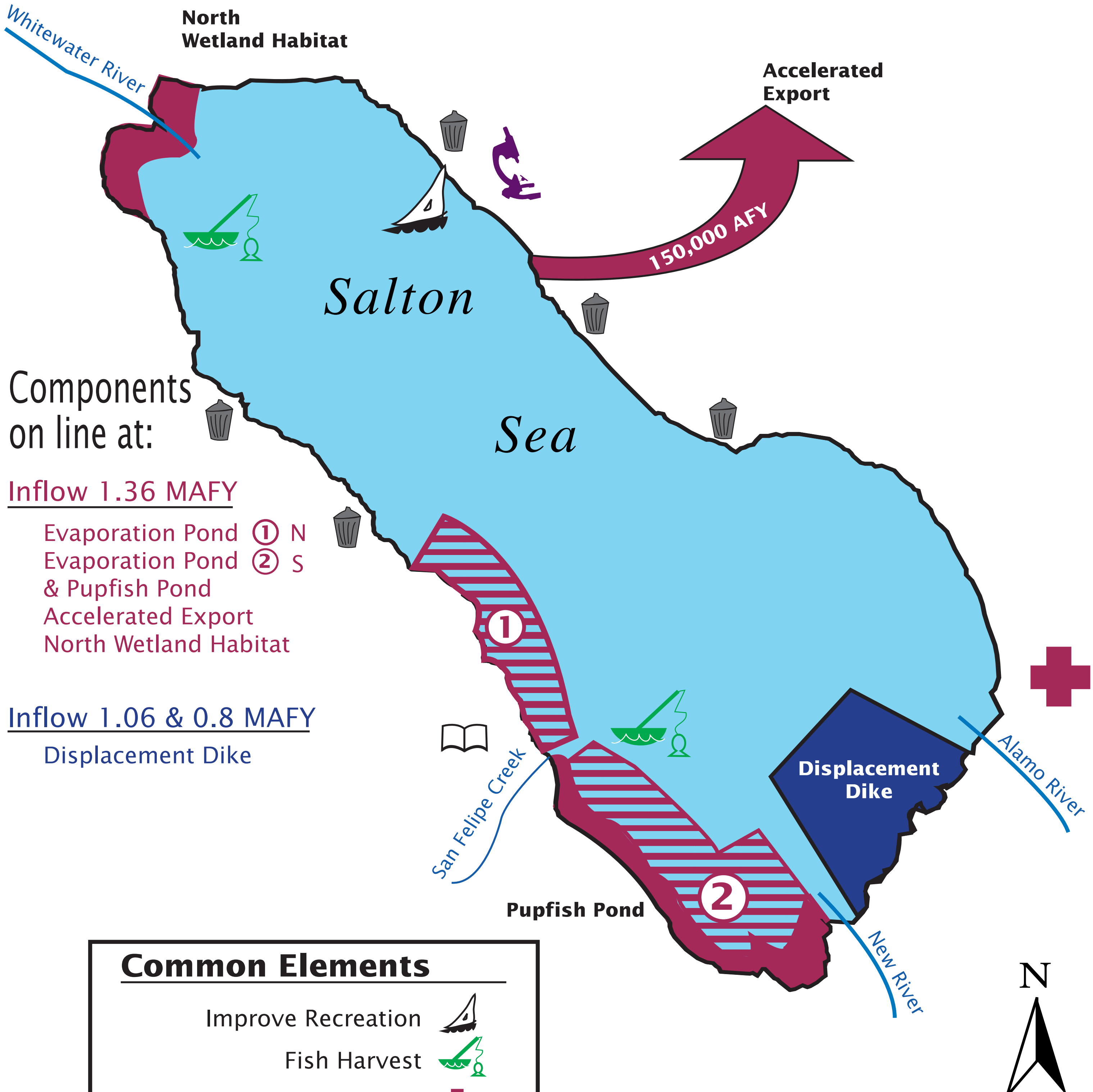
Inflow .8 million af/yr
-251 below sea level

af/yr=acre feet per year

Alternative 1

Salton Sea Alternatives

Major Actions in the First 30 Years



Common Elements

Improve Recreation

Fish Harvest

Wildlife Disease Program

Shoreline Clean up

Strategic Science Plan

Long-Term Management Plan

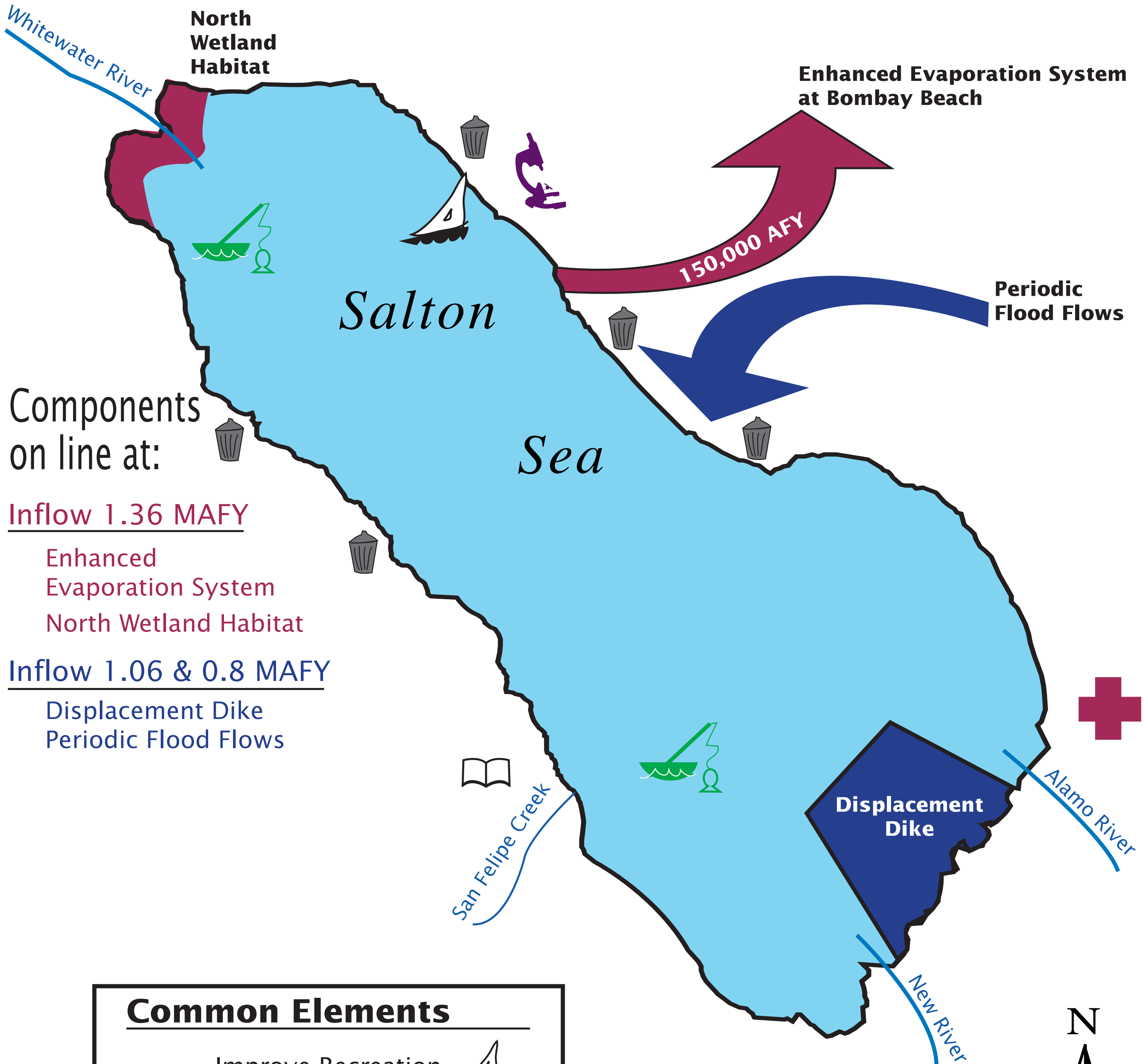
MAFY - million acre-feet per year

AFY - acre-feet per year

Alternative 2

Salton Sea Alternatives

Major Actions in the First 30 Years



Components on line at:

Inflow 1.36 MAFY

- Enhanced Evaporation System
- North Wetland Habitat

Inflow 1.06 & 0.8 MAFY

- Displacement Dike
- Periodic Flood Flows

Common Elements

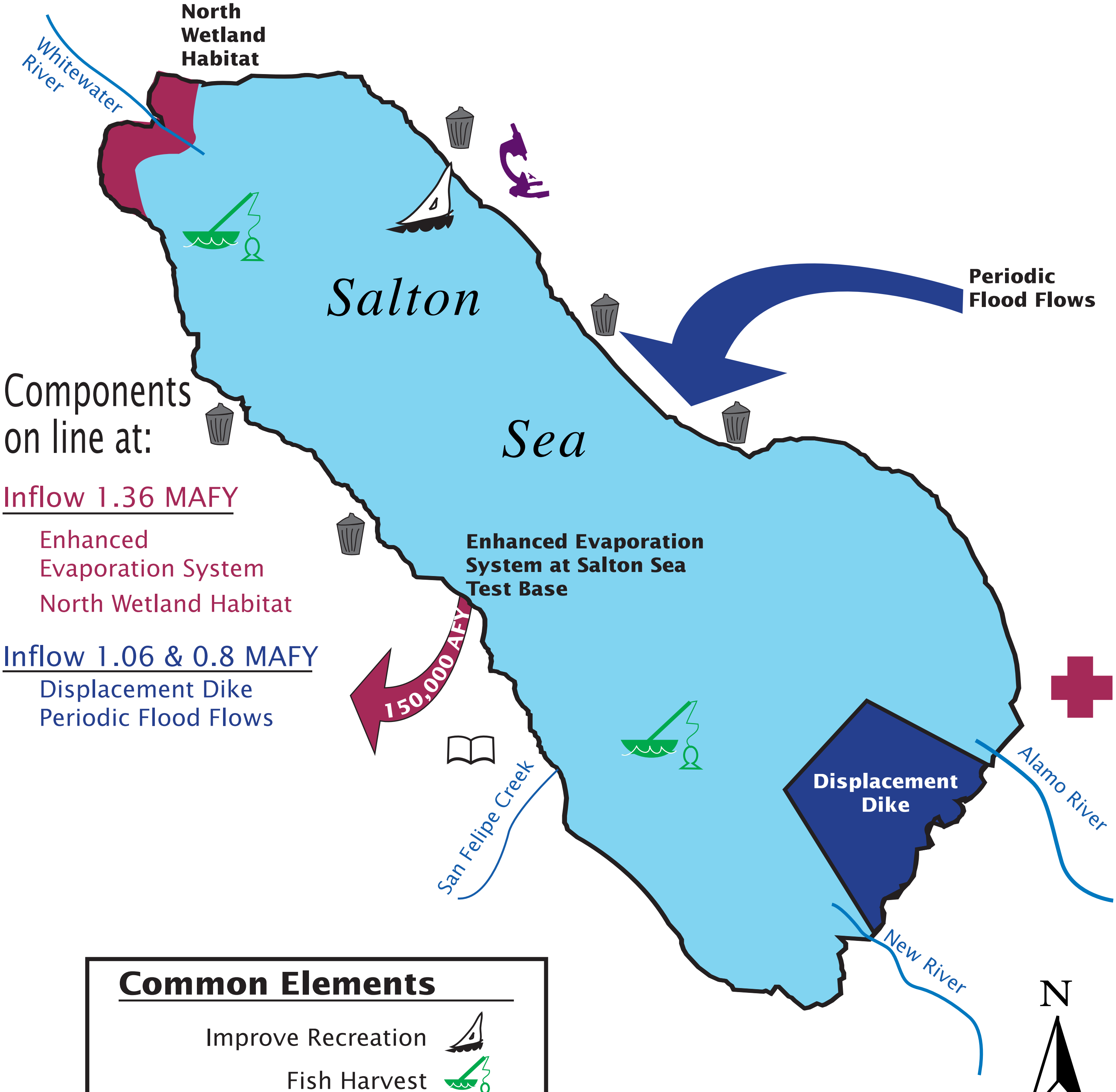
- Improve Recreation
- Fish Harvest
- Wildlife Disease Program
- Shoreline Clean up
- Strategic Science Plan
- Long-Term Management Plan

MAFY - million acre-feet per year

AFY - acre-feet per year

Alternative 3

Major Actions in the First 30 Years



Common Elements

- Improve Recreation
- Fish Harvest
- Wildlife Disease Program
- Shoreline Clean up
- Strategic Science Plan
- Long-Term Management Plan

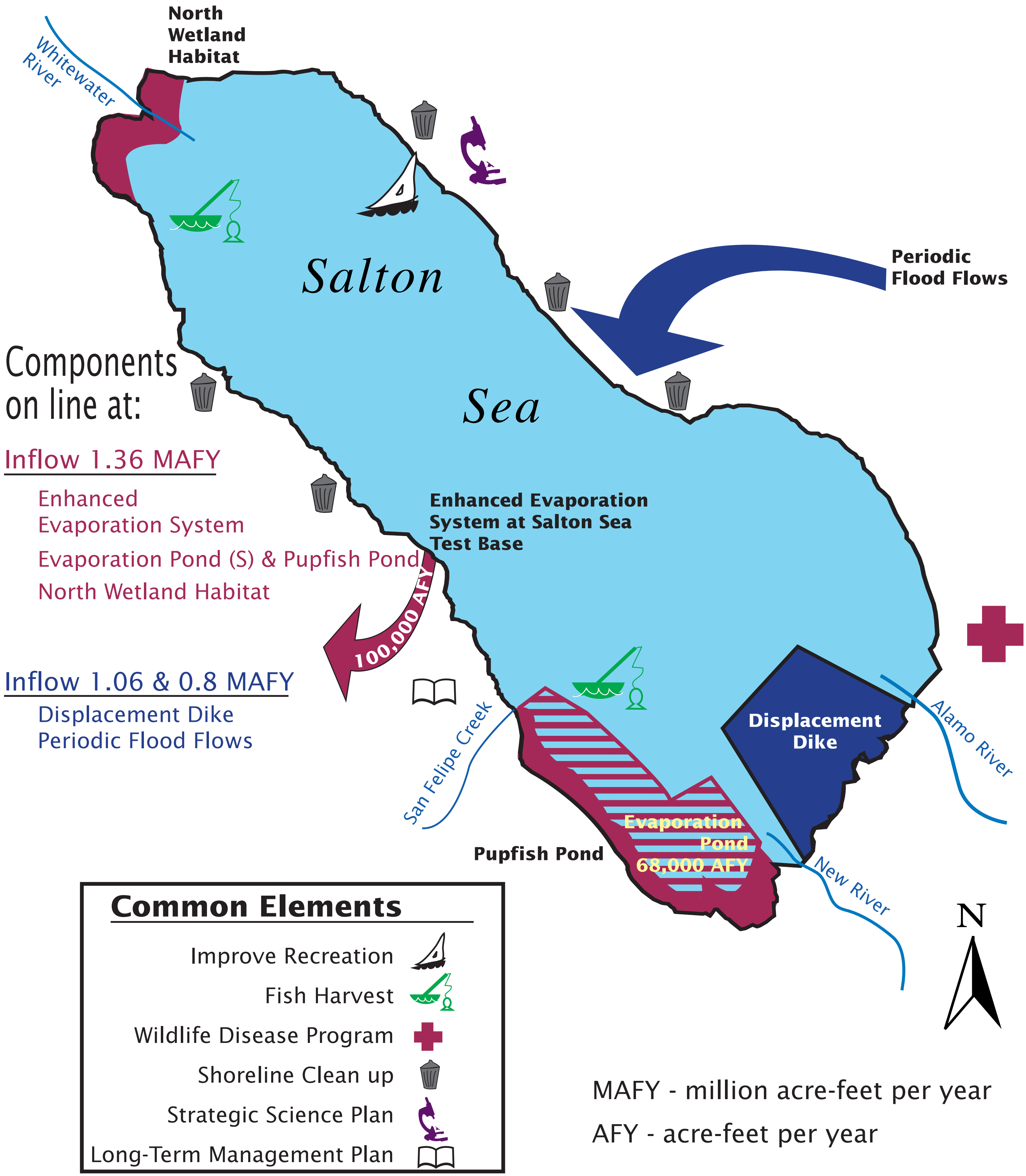
MAFY - million acre-feet per year

AFY - acre-feet per year

Alternative 4

Salton Sea Alternatives

Major Actions in the First 30 Years



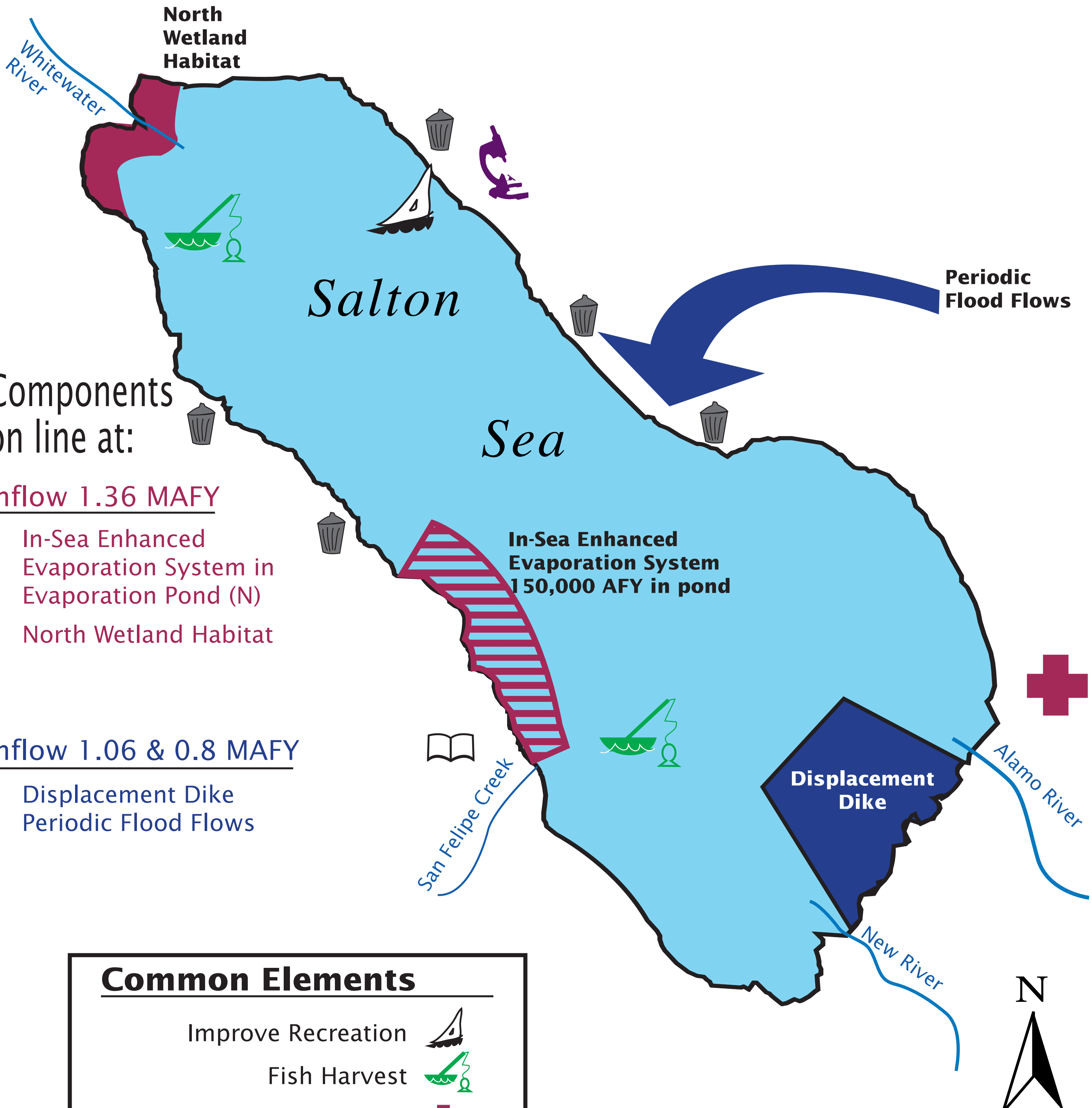
MAFY - million acre-feet per year

AFY - acre-feet per year

Alternative 5

Salton Sea Alternatives

Major Actions in the First 30 Years



Components on line at:

Inflow 1.36 MAFY

- In-Sea Enhanced Evaporation System in Evaporation Pond (N)
- North Wetland Habitat

Inflow 1.06 & 0.8 MAFY

- Displacement Dike
- Periodic Flood Flows

Common Elements

- Improve Recreation
- Fish Harvest
- Wildlife Disease Program
- Shoreline Clean up
- Strategic Science Plan
- Long-Term Management Plan

MAFY - million acre-feet per year

AFY - acre-feet per year

Other Possible Long Term Actions

Salton Sea Alternatives

APPENDIX B
SALTON SEA STRATEGIC SCIENCE PLAN EXECUTIVE SUMMARY

APPENDIX B
SALTON SEA STRATEGIC SCIENCE PLAN EXECUTIVE SUMMARY

SECTION I—INTRODUCTION

The Salton Sea is an ecosystem in peril. Its prehistory consists of a series of intermittent lakes dependent on infrequent flooding of the Colorado River, while the modern Salton Sea originated from the desire to harness the flow of the Colorado River for irrigation. What began as an accident of this attempt is now a permanent inland sea supported by wastewater and agricultural drainage rather than Colorado River flood flows. However, environmental degradation is challenging the ability of the Sea to sustain the biological components that society has learned to value as characteristics of this waterbody. Increasing salinity and increasing frequency and magnitude of wildlife losses indicate the Sea is under severe environmental stress. The Salton Sea Restoration Project originated to reverse this degradation, to stabilize fluctuating water levels, and to provide a permanent waterbody that sustains values of the human society that uses it. The project foundation is provided by Public Law (PL) 102-575, passed by Congress in 1992. PL 102-575 directs the Secretary of the Interior to "conduct a research project for the development of a method or combination of methods to reduce and control salinity, provide endangered species habitat, enhance fisheries, and protect human recreational values . . . in the area of the Salton Sea." That PL was followed by the Salton Sea Reclamation Act of 1998 (PL 105-372), which directs the Secretary of the Interior to "complete all studies, including, but not limited to environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea."

Section I of this document provides background and historical information relevant to the Salton Sea Restoration Project (SSRP). Section II highlights the activities and accomplishments of the Science Subcommittee. Section III is the conceptual framework for a continuing Salton Sea Science effort that is pragmatically focused on and linked to the SSRP. Section IV contains supplemental information referred to within the other sections.

SECTION II—SCIENCE SUBCOMMITTEE

The Salton Sea Science Subcommittee (SSC) was incorporated within the Salton Sea Restoration Project in December 1997 to guide the science effort needed to support restoration. The primary purpose of the SSC is to provide a sound scientific foundation on which management judgments can be based in considering alternatives for achieving project goals. Achieving this endpoint has been accomplished by evaluating data, identifying data gaps, and awarding contracts for focused scientific investigations. Using the principles of competition and peer review, eight reconnaissance projects and four studies of fish and avian mortality were funded in 1998 and 1999 through the Salton Sea Authority (SSA) by a research grant provided the SSA by the US Environmental Protection Agency. By September 1999, two projects had been completed and eight synthesis documents had been written to provide input to the planning documents. These investigations are providing the most comprehensive scientific evaluations of the Salton Sea ever available. An additional eight issue-specific documents were prepared by SSC members to meet urgent needs of the planning process. Findings often differ from popular perceptions and conventional wisdom about the Sea, based on earlier investigations and more fragmented scientific efforts. As a result, speculation and unknowns are being replaced by practical knowledge. The SSC also provided presentations at scientific, agency, and environmental community forums and developed a strategic science plan (SSP) to guide the long-term integration of science within the SSRP.

SECTION III—FUTURE SCIENCE ACTIVITIES

The SSP provides recommendations for the development, function, and oversight of a pragmatic science effort to support long-term management actions for restoring the Salton Sea. Development of this segment of the SSP was assisted by input resulting from an SSC request for a US Geological Survey "Tiger Team" to carry out an intense evaluation of needs. A strong scientific program specifically oriented at guiding management actions will provide a sound basis for management decisions, evaluation of progress toward achieving SSRP goals, and conceptual models for effective selection among alternatives to address specific SSRP actions.

The basic objective for the SSP is to provide a framework for a continued scientific effort in support of the restoration project that replaces the interim activities of the Science Subcommittee. This objective will be met by accomplishing the following goals:

- Establish a dedicated science office to serve as an interface with restoration efforts;
- Provide timely, objective scientific evaluation and technical assistance to management;
- Establish a long-term database program for supporting investigations and management actions; and
- Establish a steady and reliable funding base for supporting SSRP science needs.

Components of the Science Program

Environmental baselines need to be established to evaluate change from restoration efforts. Monitoring is performed to evaluate the success of restoration actions and to collect long-term data from which quantitative models can be validated. Conceptual models are used to guide the development of quantitative models by identifying processes and ecosystem functions thought to be important. Quantitative modeling then generates hypotheses about these processes and ecosystem functions that focused investigations can explore. Focused investigations fill in key information gaps, support monitoring by identifying important measures that were not initially recognized, and also help in validating quantitative models. These components interact to provide management with a solid base to assess functional system changes being achieved and the outcome of management actions relative to the SSRP goals.

Technical assistance provides the glue linking the science program to restoration management. A dedicated technical assistance component is included within this SSP to provide a focal point for management requests and to develop processes to support those requests in a timely manner.

The SSRP has need for data and information management. The projected long-term efforts of the project will be best served by formal agreement between the project and external programs for managing scientific data and information that clearly define the roles, responsibilities, and contributions of each entity. Key considerations regarding SSRP scientific data and information management are that these components are part of the integrated scientific effort rather than a separate scientific program. This is important because formatted input and availability of scientific data can be required only for investigations funded by the project. It would require a substantial investment in equipment, personnel, and facility costs to establish an internal database function within the science program.

The Science Office

Restoration of the Salton Sea is a lengthy process that will require scientific support and investigations for many years. Continuity of the science effort, effectiveness of the science undertaken in support of the SSRP, and efficiency of operations in serving management needs will be best served by a funded and staffed Science Office. This office should be established as an independent organization along with the management offices for the SSRP.

The functions of the Science Office are as follows:

- Science leadership and coordination;
- Science oversight and responsibility for SSRP science activities;
- Administration of science funding;
- Science contract awards and negotiations;
- Science outreach activities;

- Development and delivery of scientific products;
- Collaboration and coordination with the SSRP management agencies;
- Networking with external agencies and organizations for data sharing and other SSRP science needs; and
- Accountability and reporting for the science program.

The basic roles for the Science Office are that of science planning, coordination, evaluation, and contract awards and administration. The Science Office should not be involved in the internal conduct or supervision of individual scientific investigations. It is the foundation for the science program and is accountable for the quality and productivity of science efforts funded as part of the restoration project. The Science Office has two standing committees to help set priorities and to address various issues. The External Advisory Committee of stakeholders in the Salton Sea helps coordinate scientific investigations at the Sea, setting priorities and resolving science issues. The Science Advisory Committee, whose members are selected because of their technical expertise, meets as small focus groups to address specific technical issues, to assist in establishing science priorities, to serve as peer reviewers, and to provide requested scientific evaluations.

Field Station

The Salton Sea Restoration Project science activities would be greatly enhanced by a common use on-site field station. The primary purposes of this facility would be to increase cost efficiency by sharing equipment and to facilitate coordination and dialogue among scientific studies. This would be a working facility for investigators who should be isolated from external disturbances, such as tour groups and unscheduled visits by the public, media, and others. The site should provide stability for the life of the project and should not be subject to transient occupancy due to other needs for the site by the landowner. The field station could be administered by one of four entities: the private sector, as an interagency cooperative agreement for shared government facilities, as sole responsibility of a government agency, or by the Salton Sea Science Office.

Funding the Science Program

The science program has no directed purpose without the SSRP; therefore, funding for the science effort should be part of total federal appropriations for the SSRP. Base funds provided the Science Office as an annual appropriation should be augmented by contributions from the state of California, grants for specific activities, and cooperative agency science activities that are funded through agency budget processes. Base funding should be tied to Congressional authorization for the Salton Sea Restoration Project because the purpose for the science program is to provide a sound scientific foundation for management decisions and actions associated with the restoration effort. Science requires time to gather information needed by management; therefore, funding for science should not be delayed if there is a delay between SSRP authorization and appropriations for construction.

Federal funding for the Science Office will need to be provided through some federal agency as base resources to assure annual operating funds to sustain the science effort. Funding the major components of the science effort should be approached in a manner consistent with the objectives of the following components:

- Modeling and Focused Investigations—base funds, contributed funds from outside sources, and grants obtained for specific areas of inquiry.
- Monitoring—routine activities should be provided by cooperative state/federal agency programs, using their internal budget processes and existing program expertise. Nongovernment agencies also may contribute to a coordinated monitoring effort. Specialized monitoring associated with pilot and demonstration projects will require SSRP funding.
- Technical Assistance—funding to be provided by the Science Office and charged against SSRP and other management offices requesting assistance. The nature of the assistance should dictate what costs would not be borne by the Science Office.
- Data and Information Management—combined funding by the Science Office, external grants, fees for services provided, and cost-sharing arrangements with stakeholder agencies and organizations.

The Role of Review Processes in Restoration Science

External peer review is a fundamental component of quality science programs and should be an uncompromised standard for Salton Sea science. Peer review processes should be incorporated within all science activities: competitive science awards, database evaluations, data and documents released for use of the public, and collaborative science, such as monitoring.

Transition from Science Subcommittee to a Workable Science Program

Several actions are needed to assure continuity of science support for the SSRP. These include, but are not limited to, maintaining the current executive director of the SSC to oversee the transition, appointing a permanent Science Office executive director, establishing the External Advisory and Technical Advisory Committees, holding a modeling workshop to develop a conceptual model of the Sea, and producing a publication on the "State of the Salton Sea," which summarizes current knowledge from studies directed by the SSC. Most critical to continuing the science support for restoration are obtaining temporary funding for science operations until the SSRP is authorized and obtaining commitments from stakeholder agencies for continuing oversight on current Salton Sea science investigations.

APPENDIX C
AIR QUALITY

APPENDIX C: AIR QUALITY

Particulate Matter Terminology

Construction Activity Evaluation

Salton Sea Levels and Salinity

Enhanced Evaporation System Evaluation

PARTICULATE MATTER TERMINOLOGY

PARTICULATE MATTER TERMINOLOGY

Aerosols and Particulate Matter

Most people would interpret the term "aerosol" as indicating some type of liquid droplet or mist sprayed into the air. Similarly, most people would interpret the term "particulate matter" as implying a solid particle (such as dust or fly ash). Air pollution specialists, however, use the terms "aerosol" and "particulate matter" interchangeably; both terms can refer to either liquid or solid material suspended in the air. In many industrial applications the term aerosol implies small particle sizes with low settling rates; a similar connotation is sometimes evident in air pollution discussions.

Suspended particulate matter is sometimes characterized as a "dispersion aerosol" or a "condensation aerosol" according to the mechanism of formation. Dispersion aerosols are formed by mechanical abrasion (for solid particles), atomization (for liquid particles), or mechanical dispersion (for powdery solids). Condensation aerosols are formed by a phase change of gaseous compounds (e.g., by condensation of saturated or supersaturated vapors) or by chemical reactions of gases to form nonvolatile compounds.

Particle Size Terminology

Size, shape, and density are important physical characteristics of suspended particulate matter. Particle dimensions can be discussed using many different units of measure. The most common size unit used in air pollution discussions is the micrometer or micron. There are 1 million microns in a meter and 25,400 microns in an inch; 1 micron is 0.001 milimeters or 0.00003937 inches. Most people cannot distinguish individual particles with a maximum physical dimension smaller than 50 microns.

Most solid particles have fairly complex and irregular shapes, thus complicating any description of physical size. Because many different techniques are used to collect and analyze suspended particulate matter, it is important to distinguish between the various technical terms and descriptions that are commonly used to describe particle size.

Although particle size terminology implies a physical size measurement, most air pollution discussions of particle size are not based on the physical dimensions of suspended particles. In many cases, particle size terminology is merely used as a convenient shorthand for describing the aerodynamic behavior of suspended particles.

Physical particle size is important to many industrial process operations. Pollution control and medical considerations, however, are more easily addressed by considering particle behavior rather than particle size per se. Two considerations of special importance to pollution control and medical evaluations are the rate at which particles settle in still air and the extent to which particles in a moving air stream will be removed by inertial impaction if the air stream follows a bent or curved path. Large, dense particles settle rapidly and are easily removed from an air stream by inertial impaction; small, low density particles settle very slowly and tend to follow a bent or curved air stream pathway.

Approximately 20 different particle diameter definitions can be found in relevant literature from such diverse fields as soil science, geology, geomorphology, health physics, atmospheric sciences, microscopic analysis procedures, and industrial process engineering. Much of the published literature on particle size distributions simply refers to particle diameter or particle radius without clarifying which specific definition is being used. Some of the literature merely refers to particle size without clarifying whether the size value refers to a diameter or a radius.

The use of similar terminology by different disciplines is no assurance of a common definition. Both soil scientists and atmospheric scientists sometimes discuss the particle sizes involved in wind erosion processes by referring to "equivalent diameters". Unfortunately, the technical definitions of "equivalent diameter" used by these two disciplines are very different.

Even closely related disciplines use different definitions. Although both disciplines use quartz as a reference mineral in their particle size definitions, the "equivalent diameter" of soil scientists is not the same as the "equivalent hydraulic diameter" of sedimentologists and geologists. From a mathematical standpoint, the "equivalent hydraulic diameter" of sedimentologists and the "equivalent diameter" of atmospheric scientists are true equivalent diameters while the "equivalent diameter" of soil scientists is not.

The definitions used or implied most frequently in data relevant to ambient air quality discussions are presented below. Allen (1990) and Syvitski (1991) provide additional particle size definitions. A sieve diameter is usually implied when large particles have been mechanically sorted into size categories. Particle size data derived from settling velocity analyses generally will be reported as sedimentation diameters. Particle size determinations based on microscopic examination may reflect any of several definitions, with Feret's diameter, Martin's diameter, and the projected area diameter being common definitions. Particle size information provided by ambient air quality sampling instruments usually refers to the aerodynamic equivalent diameter.

Sieve Diameter. The sieve diameter of a particle is the width of the minimum square aperture through which the particle will pass. Because many particles have complex physical shapes, the sieve diameter will often be larger than the minimum physical dimension and smaller than the maximum physical dimension of the particle.

Martin's Diameter. Martin's diameter is calculated from the image of a particle viewed or photographed through a microscope. Martin's diameter is the length of a line (drawn in some fixed orientation) that bisects the particle image into two portions of equal area. Martin's diameter is determined for many individual particles, with the individual measurements used for statistical summaries.

Feret's Diameter. Feret's diameter is calculated from the two-dimensional image of a particle (generally viewed or photographed through a microscope). Feret's diameter is calculated as the distance between two tangents on opposite sides of the particle parallel to some fixed direction. Feret's diameter is determined for many individual particles, with results of the individual measurements used for statistical summaries.

Long Axis. The long axis of a particle viewed or photographed through a microscope is the maximum Feret's diameter when all possible tangent pair orientations are considered for the individual particle. Some references use the terms "maximum horizontal intercept" or "longest dimension" rather than long axis.

Maximum Chord. The maximum chord for a particle viewed or photographed through a microscope is the maximum length of a line parallel to some fixed orientation and contained entirely within the perimeter outline of the particle. Complex particle outlines may cause the maximum chord to be smaller than the corresponding Feret's diameter.

Perimeter Diameter. The perimeter diameter of a particle is the diameter of a circle having the same circumference as the perimeter of a particle viewed or photographed through a microscope.

Projected Area Diameter. The projected area diameter of a particle is the diameter of a circle having the same enclosed area as the outline of the particle (generally viewed or photographed through a microscope). Two different projected area diameter definitions are in widespread use. One definition is based on particles in a random orientation. The other definition is based on particles resting in a stable orientation. The projected area diameter is generally larger than Martin's diameter and smaller than Feret's diameter. Some references use the term "nominal sectional diameter" instead of projected area diameter.

Equivalent Spherical Diameter Because most suspended particulate matter has an irregular shape, the equivalent spherical diameter (generally referred to simply as the equivalent diameter) is used as a standardized description of physical particle size. The equivalent diameter is calculated by measuring the volume of a particle and computing the diameter of a sphere having the same volume. Some references use the terms "volume diameter" or "true nominal diameter" instead of equivalent spherical diameter.

Sedimentation (Stokes) Diameter. The sedimentation (or Stokes) diameter of a particle is based on the terminal settling velocity of a particle in still air. The sedimentation diameter is the diameter of a sphere having the same terminal settling velocity and density as the particle. Some references use the term "free-falling diameter" for evaluations based on the terminal settling velocity in fluids other than air.

Aerodynamic Equivalent Diameter. The aerodynamic equivalent diameter of a particle also is based on the terminal settling velocity of a particle in still air. The aerodynamic equivalent diameter is the diameter of a sphere with a density of 1 gram per cubic centimeter that has the same terminal settling velocity as the particle. Thus, the aerodymaic equivalent diameter differs from the sedimentation diameter of a particle whenever the real particle has a density other than 1 gram per cubic centimeter. For convenience, the term "aerodynamic equivalent diameter" is often shortened to aerodynamic diameter.

Equivalent Hydraulic Diameter. Geologists, sedimentologists, and hydrologists interested in freshwater and marine sediment transport often use a type of equivalent diameter based on spheres with the density of quartz (2.65 grams per cubic centimeter). The equivalent hydraulic diameter of a particle is the diameter of a quartz sphere having the same settling velocity in water as the particle. The term "equivalent hydraulic diameter" is often shortened to hydraulic diameter.

Equivalent Quartz Grain Diameter. Soil scientists occasionally use the term "equivalent diameter" when discussing particle sizes associated with wind erosion, but define the term differently than do atmospheric scientists. The term used by soil scientists is less ambiguous if phrased as "equivalent quartz grain diameter". Soil scientists calculate their equivalent quartz grain diameter by multiplying the sieve diameter of a particle by the density of the suspended particle or particle aggregate and dividing that product by the particle density of quartz (2.65 grams per cubic centimeter). If particle aggregates are being considered, the density of the aggregate is treated as a bulk density (including pore spaces within the particle aggregate). The equivalent quartz grain diameter of soil scientists is not really an "equivalent" diameter in any mathematical sense, and will generally differ from the hydraulic diameter of sedimentologists.

Particle Size Ranges for TSP and PM10

Federal ambient air quality standards were first established in 1970. For some pollutants, separate standards have been set for different time periods. Federal ambient air quality standards are based primarily on public health protection criteria. The numerical values of various ambient air quality standards have been changed several times. In addition, the federal ambient air quality standards for suspended particulate matter have undergone a significant change in definition, as discussed below.

Until the mid 1980s, federal particulate matter standards applied to a broad range of particle sizes and were referred to as total suspended particulate matter (TSP) standards. The high volume samplers used at TSP monitoring stations are most effective in collecting particles with an aerodynamic diameter smaller than 30-50 microns, although larger particles also are collected (U.S. Environmental Protection Agency 1982, Lodge 1989).

Health concerns associated with suspended particles focus on those particles small enough to reach the lower respiratory tract (tracheo-bronchial passages and alveoli in the lungs) when inhaled. When breathing occurs through the nose, few particles with an aerodynamic diameter larger than 10 microns reach the lower respiratory tract. When breathing occurs through the mouth, some particles with aerodynamic diameters as large as 20 microns may reach the lower respiratory tract (U.S. Environmental Protection Agency 1982). It also should be noted that not all particles with small aerodynamic diameters reach the lower respiratory tract; some are removed in the nasal passages, mouth, or upper throat regions.

The federal air quality standards for particulate matter were revised in 1987 to apply only to "inhalable" particles (generally designated PM10) with a size distribution weighted toward particles having aerodynamic diameters of 20 microns or less. The particle size distribution implied by the PM_{10} definition is intended to approximate the size distribution of particles that reach the lower respiratory tract.

It is difficult to relate the former TSP and current PM_{10} standards to a precise range of physical particle sizes. Although the TSP designation does not have any obvious particle size connotations, the use of the word "total" in total suspended particulate matter implies 100% collection efficiency over a large range of particle sizes. As is explained below, very few particle sizes are sampled with 100% efficiency by a TSP sampler.

The PM_{10} designation seems to imply a rather precise size limit. The most widely used definition of PM_{10} is "particulate matter smaller than 10 microns in (aerodynamic) diameter." Unfortunately, that simple definition is both technically wrong and very misleading, as it implies an absolute physical or aerodynamic diameter size limit of 10 microns. The only absolute size limit that can be established for PM_{10} is substantially larger than 10 microns.

The true definitions of TSP and PM_{10} are most easily derived by considering the equipment used to collect samples of suspended particulate matter. As explained below, TSP is effectively any particulate matter collected with a conventional high volume TSP sampler.

PM_{10} is defined more rigorously, and represents a fractional sampling of suspended particulate matter that approximates the extent to which suspended particles with aerodynamic equivalent diameters smaller than 50 microns penetrate to the lower respiratory tract (tracheo-bronchial airways and alveoli in the lungs). The key feature of an accurate PM_{10} definition is the fractional sampling of cumulative particle mass. Particle size enters into the definition of PM_{10} as a probability distribution, not as a precise particle size limit.

Neither the human respiratory system nor mechanical collection devices provide absolute size discrimination of particle sizes. One cannot look at an individual airborne particle with an aerodynamic diameter below 50 microns and know with absolute certainty whether or not it would reach the lower respiratory tract if inhaled. Similarly, one cannot know with absolute certainty whether that specific particle would be collected by a PM_{10} or TSP sampler.

As a practical matter PM_{10} can be defined as any particles collected by a certified PM_{10} sampler. In more technical terms, the numerical values of the federal and state PM_{10} standards are applied to suspended particulate matter collected by a certified sampling device having a 50% mass collection efficiency for particles with aerodynamic equivalent diameters of 9.5-10.5 microns and a maximum aerodynamic diameter collection limit smaller than 50 microns. Collection efficiencies are greater than 50% for particles with aerodynamic diameters smaller than 10 microns and less than 50% for particles with aerodynamic diameters larger than 10 microns. The physical dimensions of particles meeting the definition of PM_{10} can vary considerably, depending on the combination of particle shape and density.

Sampling Criteria for TSP and PM_{10} Collectors

Both the former TSP standards and the current PM_{10} standards have been defined primarily by the type of equipment used to collect suspended particulate matter samples. The sampling equipment incorporates inlet designs which are intended to exclude particles with large aerodynamic diameters. Because aerodynamic diameters are not an actual physical dimension, perfect screening of particle sizes is not possible. Some particles outside the target size range will be collected and some particles within the target size range will be excluded.

The performance of TSP and PM_{10} sampling equipment is characterized by the "aerodynamic cutpoint diameter" of the collector inlet. The aerodymamic cutpoint diameter is the aerodynamic diameter at which the device excludes 50% of the mass of the corresponding ambient particles.

Design criteria for TSP samplers do not include tight tolerances on the size distribution of collected particles. Most TSP collectors have rectangular or square inlets with a peaked-roof precipitation shield. The design of standard TSP sampler inlets causes the cutpoint diameter of a TSP collector to vary with relative wind direction and wind speed.

No specific aerodynamic cutpoint diameter criteria were specified in the former federal TSP standards. Most references (e.g., U.S. Environmental Protection Agency 1982, Lodge 1989) indicate that TSP collectors have an aerodynamic cutpoint diameter of 30-50 microns under common wind speed conditions. The limited published literature on TSP collector sampling efficiency (Wedding et al. 1977, McFarland et al. 1979) implies a much broader range of aerodynamic cutpoint diameters (13-67 microns) depending on wind speed and relative wind direction. McFarland et al. (1979) indicate that the aerodynamic cutpoint diameter of TSP collectors decreases at high wind speeds and increases at low wind speeds.

The high volume samplers used to monitor compliance with the current PM_{10} standards have a narrow aerodynamic cutpoint diameter range of 9.5-10.5 microns. PM_{10} samplers also incorporate round inlet designs that are not sensitive to relative wind direction. In addition, PM_{10} samplers are much less sensitive to wind speed than are TSP samplers.

The 10-micron component of the PM_{10} definition refers to a 50% collection efficiency measure, not an absolute size limit. When operated during wind speeds of 1-15 mph, an acceptable PM_{10} sampler must collect 45-55% of the mass of particles with aerodynamic equivalent diameters of 9.5-10.5 microns. In addition, the size-based collection efficiency curve derived for the sampler must pass a test for total particle mass collection. When the collection efficiency curve is applied to a standardized particle mass distribution, the calculated total mass of collected particles must be within 10% of the total mass calculated for the "ideal" PM_{10} sampler collection efficiency curve. The standardized particle mass distribution used for the mass collection test includes particle sizes ranging from less than 1 micron to 45 microns in aerodynamic diameter.

Although the aerodynamic cutpoint diameter is useful as a single number for charaterizing collector performance, proper understanding of the particle sizes collected by TSP and PM_{10} samplers requires a more complete description of collection efficiencies at various particle sizes.

An ideal PM_{10} sampler would collect 50% of the particle mass present in the 10-10.5 micron aerodynamic diameter size range and would not collect any particles with aerodynamic diameters larger than 16 microns. In practice, most actual PM_{10} samplers will collect some particles with aerodynamic diameters of 25-30 microns (Purdue 1988, Lippmann 1989). The formal specifications for PM_{10} samplers imply an effective aerodynamic diameter limit of 45-50 microns (40 CFR 53.43).

TABLE C-1. SIZE AND DENSITY ESTIMATES FOR ATMOSPHERIC PARTICLES

DESCRIPTION	PHYSICAL DIAMETER (microns) Lower	PHYSICAL DIAMETER (microns) Upper	NOMINAL MASS MEDIAN DIAMETER (microns)	TYPICAL PARTICLE DENSITY (gm/cm^3)	ESTIMATED SHAPE FACTOR	APPROXIMATE AERODYNAMIC EQUIVALENT DIAMETER (microns) Lower	M-Median	Upper
Forest/range fire smoke	0.01	1.5	0.95	1.6	1.20	0.010	0.806	1.27
Ash from forest/range fires	5	1000	631	1.2	3.00	4.17	526	833
Photochemical smog aerosols	0.01	1.5	0.95	2.0	1.05	0.011	0.812	1.27
Oil smoke	0.04	1	0.64	2.0	1.05	0.043	0.555	0.856
Tobacco Smoke	0.01	1	0.63	1.6	1.20	0.010	0.543	0.850
Zinc oxide fumes	0.01	0.4	0.25	5.606	1.10	0.018	0.254	0.375
Ammonium chloride fumes	0.1	3	1.91	1.527	1.10	0.095	1.61	2.51
Sulfuric acid mist	1	20	12.8	1.841	1.05	0.854	10.7	16.7
Carbon black	0.01	0.3	0.19	1.95	1.08	0.011	0.180	0.271
Coal dust	1	100	63.2	1.5	1.08	0.847	52.7	83.3
Cement dust	3	100	63.6	3.2	1.08	2.53	53.1	83.4
Milled flour	1	90	56.9	0.8	1.10	0.825	47.4	75.0
Chalk dust	2	50	31.9	2.5	1.10	1.69	26.6	41.7
Ground talc	4	60	38.7	2.7	2.04	3.36	32.3	50.0
Dust storm particles	1	50	31.7	2.0	1.57	0.854	26.4	41.7
Sand storm particles	1	200	126	2.5	1.57	0.860	105	167
Clay	0.05	2	1.27	2.2	1.57	0.056	1.08	1.69
Silt	2	50	31.9	1.8	1.57	1.69	26.6	41.7
Fine sand	50	100	77.7	2.65	1.57	41.7	64.8	83.4
Medium sand	100	500	339	2.65	1.57	83.4	283	417
Coarse sand	500	1000	777	2.65	1.57	417	647	833
Very coarse sand	1000	2000	1,554	2.65	1.57	833	1,295	1,667
Gravel	2000	4000	3,107	2.65	1.57	1,667	2,589	3,333
Dolomite (or shell) sands	50	4000	2,530	2.3	1.75	41.7	2,109	3,333
Volcanic ash	2	500	315	2.5	2.00	1.69	263	417
Viruses	0.002	0.3	0.19	1.0	1.10	0.002	0.158	0.250
Bacteria	0.5	30	19.0	1.0	1.10	0.417	15.8	25.0
Spores	0.5	40	25.3	1.4	1.10	0.428	21.1	33.3
Pollen	10	100	65.2	1.4	1.10	8.35	54.4	83.3
Ocean whitecap spray	0.1	60	37.8	1.025	1.05	0.084	31.5	50.0
Sea salt nuclei	0.03	0.4	0.26	2.17	1.10	0.034	0.239	0.356
Na, Mg, Ca, K chloride mix	0.03	0.4	0.26	2.175	1.10	0.035	0.239	0.356
Sea salt crystals, RH < 70%	0.03	12	7.57	2.17	1.10	0.034	6.33	10.0
Sea salt crystals, hydrated	0.7	25	15.9	1.2	1.10	0.588	13.3	20.8
Hydraulic nozzle droplets	40	5000	3,158	1.0	1.05	33.3	2,632	4,167
Cloud/Fog droplet	7	40	26.9	1.0	1.05	5.83	22.4	33.3
Mist	40	300	198	1.0	1.05	33.3	165	250
Drizzle	200	500	370	1.0	1.05	167	309	417
Small Raindrops	500	3000	2,008	1.0	1.05	417	1,673	2,500
Large Raindrops	3000	10000	7,076	1.0	1.05	2,500	5,896	8,333

TABLE C-1. SIZE AND DENSITY ESTIMATES FOR ATMOSPHERIC PARTICLES

DESCRIPTION	PHYSICAL DIAMETER (microns) Lower	Upper	NOMINAL MASS MEDIAN DIAMETER (microns)	TYPICAL PARTICLE DENSITY (gm/cm^3)	ESTIMATED SHAPE FACTOR	APPROXIMATE AERODYNAMIC EQUIVALENT DIAMETER (microns) Lower	M-Median	Upper
Snowflakes	500	20000	12,706	0.4	3.00	417	10,588	16,667
Graupel	1000	7000	4,642	0.7	1.27	833	3,868	5,833
Sleet	200	3000	1,934	0.7	1.35	167	1,612	2,500
Hail	3000	100000	63,639	0.7	1.08	2,500	53,032	83,333

Note: Inconsistencies among data sources resolved by professional judgement.
Soil particle size classification based on U.S. Department of Agriculture terminology.
Aerodynamic diameter estimates account for densities, shape factors, and Cunningham slip factors. Cunningham slip factor calculations use six iterations for the lower size range, five iterations for the mass median size, and four interations for the upper size range.

Data Sources for particle size ranges:

Lapple, C. E. 1961. Characteristics of Particles and Particle Dispersoids. Stanford Research Institute Journal, Vol. 5, Page 95. Reproduced as page F-285 in R. C. Weast (ed.), 1980, Handbook of Chemistry and Physics, 61st Edition, CRC Press. Boca Raton, FL.

Schaefer, Vincent J. and John A. Day. 1981. A Field Guide to the Atmosphere. Peterson Field Guide Series 26. Houghton Mifflin Company. Boston, MA.

Wild, Alan. 1993. Soils and the Environment: an Introduction. Cambridge University Press. New York, NY.

Willeke, Klaus, and Paul A. Baron. 1993. Aerosol Measurement: Principles, Techniques, and Applications. Van Nostrand Reinhold. New York, NY.

Data Sources for particle density or specific gravity:

Cook, James L. 1991. Conversion Factors. Oxford University Press. New York, NY.

Gieck, Kurt, and Reiner Gieck. 1990. Engineering Formulas. Sixth Edition. McGraw-Hill, Inc. New York, NY.

Weast, Robert C. (ed.). 1980. Handbook of Chemistry and Physics. 61st Edition. CRC Press. Boca Raton, FL.

Data Sources for aerodynamic diameter calulations:

Hering, S. V. 1989. Inertial and gravitational collectors. Pages 337-385 in S. V. Hering (ed.), Air Sampling Instruments for Evaluation of Atmospheric Contaminants, Seventh edition. American Conference of Governmental Industrial Hygienists. Cincinnati, OH.

Hesketh, H. E. 1991. Air Pollution Control: Traditional and Hazardous Pollutants. Technomic Publishing Company. Lancaster, PA.

Willeke, Klaus, and Paul A. Baron. 1993. Aerosol Measurement: Principles, Techniques, and Applications. Van Nostrand Reinhold. New York, NY.

CONSTRUCTION ACTIVITY EVALUATION

TABLE C-37. ESTIMATED PM10 FRACTIONS FOR SOIL TEXTURE CATEGORIES

SOIL TEXTURE CLASS	PERCENT CLAY + SILT	ESTIMATED % PM10
Clay	55 - 100 %	40 - 85 %
Silt	80 - 100 %	40 - 80 %
Silty Clay	80 - 100 %	40 - 70 %
Silty Loam	50 - 100 %	30 - 70 %
Silty Clay Loam	80 - 100 %	30 - 60 %
Clay Loam	45 - 80 %	30 - 50 %
Loam	45 - 75 %	25 - 45 %
Sandy Clay	35 - 55 %	25 - 45 %
Sandy Clay Loam	20 - 55 %	15 - 40 %
Sandy Loam	15 - 55 %	10 - 30 %
Sand	0 - 15 %	0 - 10 %

Notes:

PM10 = inhalable particulate matter (a size-dependent fractional sampling of particles smaller than 50 microns aerodynamic equivalent diameter). PM10 samplers collect 100% of submicron particles, 50% of 10 micron particles, and 0% of 50 micron particles.

Clay = soil particles with a sieve diameter below 2 microns (but may form large particle aggregates).

Silt = soil particles with a sieve diameter between 2 and 50 microns.

1 micron = 0.001 millimeters = 0.00003937 inches

Soil texture classes and associated clay plus silt fractions are based on the U.S. Department of Agriculture texture classification system as presented in Wild (1993).

A sieve diameter is the width of the minimum screen opening (usually square) through which a particle will pass. Because many particles have complex shapes, the sieve diameter will usually be larger than the minimum physical dimension and smaller than the maximum physical dimension.

An aerodynamic equivalent diameter is a mathematical abstraction, not a physical dimension. The aerodynamic equivalent diameter is the diameter of a sphere with unit density (1 gram per cubic centimeter) having the same gravitational settling velocity as the actual particle under consideration.

Reference:

Wild, Alan. 1993. Soils and the Environment: An Introduction. Cambridge University Press.

TABLE C-38. FUGITIVE DUST GENERATED BY CONSTRUCTION TRAFFIC ON UNPAVED ROADS: ALTERNATIVE 1

MATERIAL HAULING:	N Pond	S Pond	Total
Aggregate, cubic yards:	10,944,000	10,093,000	21,037,000
Rip-rap, cubic yards:	226,000	264,000	490,000
Total, cubic yards:	11,170,000	10,357,000	21,527,000

Years for construction period:	4
Cubic Yards per Year:	5,381,750
Typical Load Density, tons/cubic yard:	1.5
Tons per Year:	8,072,625
Work Days per Year:	250
Haul Truck Capacity (tons):	100
Daily Truck Loads:	323
Empty Truck Weight (tons):	60

FUGITIVE DUST PARAMETERS:		
silt+clay fraction =	5	percent
precipitation days =	15	days per year
dust control effect =	65	percent
Round trip time:	3.5	hours
Required haul trucks:	113	for 10-hour day

TYPE OF VEHICLE OR ITEM	NUMBER OF VEHICLES (if known)	1-WAY ROUTE DISTANCE (MILES)	TOTAL 1-WAY TRIPS PER DAY	ACTIVE USE DAYS PER YEAR	ANNUAL VMT ON UNPAVED ROADS	GROSS VEHICLE WEIGHT (tons)	NUMBER OF WHEELS	AVERAGE DRIVING SPEED (mph)	TONS OF FUGITIVE PM10 PER YEAR
	OPTIONAL DATA FOR VMT CALCULATIONS								
CONSTRUCTION WORKER VEHICLES	440	2	880	250	440,000	3.5	4	15	36.4
WATER TRUCK (2,500 gallons)		18	20	250	90,000	29.0	8	10	30.8
100-TON OFF-ROAD HAULER, LOADED	113	18	323	250	1,453,500	160.0	6	10	1,425.6
100-TON OFF-ROAD HAULER, EMPTY	113	18	323	250	1,453,500	60.0	6	15	1,076.2
HEAVY EQUIPMENT TRANSPORTERS, LOADED		2	20	5	200	92.0	12	10	0.2
HEAVY EQUIPMENT TRANSPORTERS, EMPTY		2	20	5	200	60.0	12	15	0.2
ANNUAL TOTALS									2,569.5

Notes: PM10 = inhalable particulate matter
VMT = vehicle miles traveled
Fugitive dust calculations are based on EPA unpaved road equations in AP-42 (Volume I, Section 13.2.2):
Tons/year = (0.36*5.9*((silt+clay)/12)*(speed/30)*((gvw/3)^0.7)*((wheels/4)^0.5)*(annual vmt)*
((365-precip days)/365)*((100-control)/100)/2000

TABLE C-39. EXHAUST EMISSIONS GENERATED BY CONSTRUCTION TRAFFIC: ALTERNATIVE 1

TYPE OF VEHICLE OR ITEM	CUMULATIVE OPERATING HOURS PER YEAR	ENGINE SIZE (hp)	EXHAUST EMISSION RATE (grams/vehicle-mile for light duty vehicles) (grams/horsepower-hour for heavy vehicles) ROG	NOx	CO	SOx	PM10	LOAD FACTOR	ANNUAL EXHAUST EMISSIONS (tons/year) ROG	NOx	CO	SOx	PM10
CONSTRUCTION WORKER VEHICLES	na	na	0.91	0.90	8.83	0.03	3.09	na	3.5	3.5	34.1	0.1	11.9
WATER TRUCK (2,500 gallons)	9,000.0	445	0.86	9.6	2.8	0.89	0.8	60%	2.3	25.4	7.4	2.4	2.1
100-TON OFF-ROAD HAULER, LOADED	145,350.0	940	0.86	9.6	2.8	0.89	0.8	95%	123.0	1,373.5	400.6	127.3	114.5
100-TON OFF-ROAD HAULER, EMPTY	96,900.0	940	0.86	9.6	2.8	0.89	0.8	50%	43.2	481.9	140.6	44.7	40.2
HEAVY EQUIPMENT TRANSPORTERS, LOAD	20.0	445	0.86	9.6	2.8	0.89	0.8	95%	0.0	0.1	0.0	0.0	0.0
HEAVY EQUIPMENT TRANSPORTERS, EMPT	13.3	445	0.86	9.6	2.8	0.89	0.8	50%	0.0	0.0	0.0	0.0	0.0
ANNUAL TOTALS									172.0	1,884.5	582.7	174.5	168.7

Notes: Construction worker vehicle emissions based on the EMFAC7 vehicle emission rate program.
Heavy truck emissions based on EPA 1991, Nonroad Engine and Vehicle Emission Study.

CONSTRUCTION WORKER TRAFFIC: 3499925 cumulative vmt/year 1 pound: 453.59237 grams
mean trip time: 21.45 minutes
mean trip distance: 15.91 miles

mph:	15	25	35	45	55	mean	
% time vs speed:	5%	10%	10%	35%	40%	rate	
ROG rate:	1.17	0.72	0.61	0.54	0.57	0.61	
NOx rate:	0.87	0.72	0.71	0.82	1.07	0.90	
CO rate:	11.10	9.44	8.71	8.38	8.83	8.83	
SOx rate:	0.03	0.03	0.03	0.03	0.03	0.03	
PM10 rate:	3.09	3.09	3.09	3.09	3.09	3.09	includes 2.88 gm/vmt resuspended dust

soak: 0.42 g/trip drnl: 8.55 g/veh-day

TABLE C-40. FUGITIVE DUST GENERATED BY CONSTRUCTION TRAFFIC ON UNPAVED ROADS: ALTERNATIVES 2 AND 3

MATERIAL HAULING:	Towers	Hose Sets	Total
Number of Modules:			75
Items per module:	30	20	50
Total number of items:	2,250	1,500	3,750

Years for construction period:	3
Truck loads per tower assembly:	4
Truck loads per hose assembly:	2
Work Days per Year:	250
Haul Truck Capacity (tons):	10
Empty Truck Weight (tons):	19
Daily Truck Loads:	16

FUGITIVE DUST PARAMETERS:

silt+clay fraction =	5	percent
precipitation days =	15	days per year
dust control effect =	65	percent

	OPTIONAL DATA FOR VMT CALCULATIONS								
TYPE OF VEHICLE OR ITEM	NUMBER OF VEHICLES (if known)	1-WAY ROUTE DISTANCE (MILES)	TOTAL 1-WAY TRIPS PER DAY	ACTIVE USE DAYS PER YEAR	ANNUAL VMT ON UNPAVED ROADS	GROSS VEHICLE WEIGHT (tons)	NUMBER OF WHEELS	AVERAGE DRIVING SPEED (mph)	TONS OF FUGITIVE PM10 PER YEAR
CONSTRUCTION WORKER VEHICLES	260	1.5	520	250	195,000	3.5	4	15	16.13
10-TON TRUCKS, LOADED	16	1.5	16	250	6,000	29.0	8	10	2.06
10-TON TRUCKS. EMPTY	16	1.5	16	250	6,000	19.0	8	15	2.29
WATER TRUCK (2,500 gallons)		1.5	10	250	3,750	29.0	8	10	1.28
HEAVY EQUIPMENT TRANSPORTERS, LOADED		1.5	20	5	150	92.0	12	10	0.14
HEAVY EQUIPMENT TRANSPORTERS, EMPTY		1.5	20	5	150	60.0	12	15	0.16
ANNUAL TOTALS									22.1

Notes: PM10 = inhalable particulate matter
VMT = vehicle miles traveled
Fugitive dust calculations are based on EPA unpaved road equations in AP-42 (Volume I, Section 13.2.2):
Tons/year = (0.36*5.9*((silt+clay)/12)*(speed/30)*((gvw/3)^0.7)*((wheels/4)^0.5)*(annual vmt)*((365-precip days)/365)*((100-control)/100)/2000

TABLE C-41. EXHAUST EMISSIONS GENERATED BY CONSTRUCTION TRAFFIC: ALTERNATIVES 2 AND 3

TYPE OF VEHICLE OR ITEM	CUMULATIVE OPERATING HOURS PER YEAR	ENGINE SIZE (hp)	EXHAUST EMISSION RATE (grams/vehicle-mile for light duty vehicles) (grams/horsepower-hour for heavy vehicles)					LOAD FACTOR	ANNUAL EXHAUST EMISSIONS (tons/year)				
			ROG	NOx	CO	SOx	PM10		ROG	NOx	CO	SOx	PM10
CONSTRUCTION WORKER VEHICLES	na	na	0.91	0.90	8.83	0.03	3.09	na	2.1	2.1	20.1	0.1	7.0
10-TON TRUCKS, LOADED	600.0	445	0.86	9.6	2.8	0.89	0.8	60%	0.2	1.7	0.5	0.2	0.1
10-TON TRUCKS, EMPTY	400.0	445	0.86	9.6	2.8	0.89	0.8	95%	0.2	1.8	0.5	0.2	0.1
WATER TRUCK (2,500 gallons)	375.0	445	0.86	9.6	2.8	0.89	0.8	50%	0.1	0.9	0.3	0.1	0.1
HEAVY EQUIPMENT TRANSPORTERS, LOAD	15.0	445	0.86	9.6	2.8	0.89	0.8	95%	0.0	0.1	0.0	0.0	0.0
HEAVY EQUIPMENT TRANSPORTERS, EMPT	10.0	445	0.86	9.6	2.8	0.89	0.8	50%	0.0	0.0	0.0	0.0	0.0
ANNUAL TOTALS									2.5	6.5	21.4	0.5	7.4

Notes: Construction worker vehicle emissions based on the EMFAC7 vehicle emission rate program.
Heavy truck emissions based on EPA 1991, Nonroad Engine and Vehicle Emission Study.

CONSTRUCTION WORKER TRAFFIC: 2068137. cumulative vmt/year   1 pound: 453.59237 grams
avg trip time: 21.45 minutes
avg trip distance: 15.91 miles

mph	15	25	35	45	55	mean	
% time at speed	5%	10%	10%	35%	40%	rate	
ROG rate	1.17	0.72	0.61	0.54	0.57	0.61	
NOx rate	0.87	0.72	0.71	0.82	1.07	0.90	
CO rate	11.10	9.44	8.71	8.38	8.83	8.83	
SOx rate	0.03	0.03	0.03	0.03	0.03	0.03	
PM10 rate	3.09	3.09	3.09	3.09	3.09	3.09	includes 2.88 gm/vmt resuspended dust

soak: 0.42 g/trip   drnl: 8.55 g/veh-day

TABLE C-42. FUGITIVE DUST GENERATED BY CONSTRUCTION TRAFFIC ON UNPAVED ROADS: ALTERNATIVE 4

MATERIAL HAULING:	N Pond
Aggregate, cubic yards:	10,944,000
Rip-rap, cubic yards:	226,000
Total, cubic yards:	11,170,000

Years for construction period:	3
Cubic Yards per Year:	3,723,333
Typical Load Density, tons/cubic yard:	1.5
Tons per Year:	5,585,000
Work Days per Year:	250
Haul Truck Capacity (tons):	100
Daily Truck Loads:	223
Empty Truck Weight (tons):	60

FUGITIVE DUST PARAMETERS:		
silt+clay fraction =	5	percent
precipitation days =	15	days per year
dust control effect =	65	percent
Round trip time:	3.5	hours
Required haul trucks:	78	for 10-hour day

TYPE OF VEHICLE OR ITEM	NUMBER OF VEHICLES (if known)	1-WAY ROUTE DISTANCE (MILES)	TOTAL 1-WAY TRIPS PER DAY	ACTIVE USE DAYS PER YEAR	ANNUAL VMT ON UNPAVED ROADS	GROSS VEHICLE WEIGHT (tons)	NUMBER OF WHEELS	AVERAGE DRIVING SPEED (mph)	TONS OF FUGITIVE PM10 PER YEAR
	OPTIONAL DATA FOR VMT CALCULATIONS								
CONSTRUCTION WORKER VEHICLES	300	2	600	250	300,000	3.5	4	15	24.8
WATER TRUCK (2,500 gallons)		18	20	250	90,000	29.0	8	10	30.8
100-TON OFF-ROAD HAULER, LOADED	78	18	223	250	1,003,500	160.0	6	10	984.2
100-TON OFF-ROAD HAULER, EMPTY	78	18	223	250	1,003,500	60.0	6	15	743.0
HEAVY EQUIPMENT TRANSPORTERS, LOADED		2	20	5	200	92.0	12	10	0.2
HEAVY EQUIPMENT TRANSPORTERS, EMPTY		2	20	5	200	60.0	12	15	0.2
ANNUAL TOTALS									1,783.3

Notes: PM10 = inhalable particulate matter
VMT = vehicle miles traveled
Fugitive dust calculations are based on EPA unpaved road equations in AP-42 (Volume I, Section 13.2.2):
Tons/year = (0.36*5.9*((silt+clay)/12)*(speed/30)*((gvw/3)^0.7)*((wheels/4)^0.5)*(annual vmt)*
((365-precip days)/365)*((100-control)/100)/2000

TABLE C-43. EXHAUST EMISSIONS GENERATED BY CONSTRUCTION TRAFFIC: ALTERNATIVE 4

TYPE OF VEHICLE OR ITEM	CUMULATIVE OPERATING HOURS PER YEAR	ENGINE SIZE (hp)	EXHAUST EMISSION RATE (grams/vehicle-mile for light duty vehicles) (grams/horsepower-hour for heavy vehicles) ROG	NOx	CO	SOx	PM10	LOAD FACTOR	ANNUAL EXHAUST EMISSIONS (tons/year) ROG	NOx	CO	SOx	PM10
CONSTRUCTION WORKER VEHICLES	na	na	0.91	0.90	8.83	0.03	3.09	na	2.4	2.4	23.2	0.1	8.1
WATER TRUCK (2,500 gallons)	9,000.0	445	0.86	9.6	2.8	0.89	0.8	60%	2.3	25.4	7.4	2.4	2.1
100-TON OFF-ROAD HAULER, LOADED	100,350.0	940	0.86	9.6	2.8	0.89	0.8	95%	85.0	948.3	276.6	87.9	79.0
100-TON OFF-ROAD HAULER, EMPTY	66,900.0	940	0.86	9.6	2.8	0.89	0.8	50%	29.8	332.7	97.0	30.8	27.7
HEAVY EQUIPMENT TRANSPORTERS, LOAD	20.0	445	0.86	9.6	2.8	0.89	0.8	95%	0.0	0.1	0.0	0.0	0.0
HEAVY EQUIPMENT TRANSPORTERS, EMPT	13.3	445	0.86	9.6	2.8	0.89	0.8	50%	0.0	0.0	0.0	0.0	0.0
ANNUAL TOTALS									119.4	1,309.0	404.3	121.2	117.0

Notes: Construction worker vehicle emissions based on the EMFAC7 vehicle emission rate program.
Heavy truck emissions based on EPA 1991, Nonroad Engine and Vehicle Emission Study.

CONSTRUCTION WORKER TRAFFIC: 2386312. cumulative vmt/year   1 pound: 453.59237 grams
mean trip time: 21.45 minutes
mean trip distance: 15.91 miles

mph:	15	25	35	45	55	mean	
% time vs speed:	5%	10%	10%	35%	40%	rate	
ROG rate:	1.17	0.72	0.61	0.54	0.57	0.61	
NOx rate:	0.87	0.72	0.71	0.82	1.07	0.90	
CO rate:	11.10	9.44	8.71	8.38	8.83	8.83	
SOx rate:	0.03	0.03	0.03	0.03	0.03	0.03	
PM10 rate:	3.09	3.09	3.09	3.09	3.09	3.09	includes 2.88 gm/vmt resuspended dust

soak: 0.42 g/trip   drnl: 8.55 g/veh-day

TABLE C-44. FUGITIVE DUST GENERATED BY CONSTRUCTION TRAFFIC ON UNPAVED ROADS: ALTERNATIVE 5

MATERIAL HAULING:	S Pond
Aggregate, cubic yards:	10,093,000
Rip-rap, cubic yards:	264,000
Total, cubic yards:	10,357,000

Years for construction period:	3			
Cubic Yards per Year:	3,452,333	FUGITIVE DUST PARAMETERS:		
Typical Load Density, tons/cubic yard:	1.5	silt+clay fraction =	5	percent
Tons per Year:	5,178,500	precipitation days =	15	days per year
Work Days per Year:	250	dust control effect =	65	percent
Haul Truck Capacity (tons):	100			
Daily Truck Loads:	207	Round trip time:	3.5	hours
Empty Truck Weight (tons):	60	Required haul trucks:	72	for 10-hour day

	OPTIONAL DATA FOR VMT CALCULATIONS								
TYPE OF VEHICLE OR ITEM	NUMBER OF VEHICLES (if known)	1-WAY ROUTE DISTANCE (MILES)	TOTAL 1-WAY TRIPS PER DAY	ACTIVE USE DAYS PER YEAR	ANNUAL VMT ON UNPAVED ROADS	GROSS VEHICLE WEIGHT (tons)	NUMBER OF WHEELS	AVERAGE DRIVING SPEED (mph)	TONS OF FUGITIVE PM10 PER YEAR
CONSTRUCTION WORKER VEHICLES	300	2	600	250	300,000	3.5	4	15	24.8
WATER TRUCK (2,500 gallons)		18	20	250	90,000	29.0	8	10	30.8
100-TON OFF-ROAD HAULER, LOADED	72	18	207	250	931,500	160.0	6	10	913.6
100-TON OFF-ROAD HAULER, EMPTY	72	18	207	250	931,500	60.0	6	15	689.7
HEAVY EQUIPMENT TRANSPORTERS, LOADED		2	20	5	200	92.0	12	10	0.2
HEAVY EQUIPMENT TRANSPORTERS, EMPTY		2	20	5	200	60.0	12	15	0.2
ANNUAL TOTALS									1,659.4

Notes: PM10 = inhalable particulate matter
VMT = vehicle miles traveled
Fugitive dust calculations are based on EPA unpaved road equations in AP-42 (Volume I, Section 13.2.2):
Tons/year = (0.36*5.9*((silt+clay)/12)*(speed/30)*((gvw/3)^0.7)*((wheels/4)^0.5)*(annual vmt)*
((365-precip days)/365)*((100-control)/100)/2000

TABLE C-45. EXHAUST EMISSIONS GENERATED BY CONSTRUCTION TRAFFIC: ALTERNATIVE 5

TYPE OF VEHICLE OR ITEM	CUMULATIVE OPERATING HOURS PER YEAR	ENGINE SIZE (hp)	EXHAUST EMISSION RATE (grams/vehicle-mile for light duty vehicles) (grams/horsepower-hour for heavy vehicles) ROG	NOx	CO	SOx	PM10	LOAD FACTOR	ANNUAL EXHAUST EMISSIONS (tons/year) ROG	NOx	CO	SOx	PM10
CONSTRUCTION WORKER VEHICLES	na	na	0.91	0.90	8.83	0.03	3.09	na	2.4	2.4	23.2	0.1	8.1
WATER TRUCK (2,500 gallons)	9,000.0	445	0.86	9.6	2.8	0.89	0.8	60%	2.3	25.4	7.4	2.4	2.1
100-TON OFF-ROAD HAULER, LOADED	93,150.0	940	0.86	9.6	2.8	0.89	0.8	95%	78.9	880.3	256.7	81.6	73.4
100-TON OFF-ROAD HAULER, EMPTY	62,100.0	940	0.86	9.6	2.8	0.89	0.8	50%	27.7	308.9	90.1	28.6	25.7
HEAVY EQUIPMENT TRANSPORTERS, LOAD	20.0	445	0.86	9.6	2.8	0.89	0.8	95%	0.0	0.1	0.0	0.0	0.0
HEAVY EQUIPMENT TRANSPORTERS, EMPT	13.3	445	0.86	9.6	2.8	0.89	0.8	50%	0.0	0.0	0.0	0.0	0.0
ANNUAL TOTALS									111.2	1,217.0	377.5	112.7	109.3

Notes: Construction worker vehicle emissions based on the EMFAC7 vehicle emission rate program.
Heavy truck emissions based on EPA 1991, Nonroad Engine and Vehicle Emission Study.

CONSTRUCTION WORKER TRAFFIC: 2386312. cumulative vmt/year   1 pound: 453.59237 grams
mean trip time: 21.45 minutes
mean trip distance: 15.91 miles

mph:	15	25	35	45	55	mean	
% time vs speed:	5%	10%	10%	35%	40%	rate	
ROG rate:	1.17	0.72	0.61	0.54	0.57	0.61	
NOx rate:	0.87	0.72	0.71	0.82	1.07	0.90	
CO rate:	11.10	9.44	8.71	8.38	8.83	8.83	
SOx rate:	0.03	0.03	0.03	0.03	0.03	0.03	
PM10 rate:	3.09	3.09	3.09	3.09	3.09	3.09	includes 2.88 gm/vmt resuspended dust

soak: 0.42 g/trip   drnl: 8.55 g/veh-day

TABLE C-46. FUGITIVE TSP GENERATED BY CONSTRUCTION TRAFFIC ON UNPAVED ROADS: ALTERNATIVE 1

MATERIAL HAULING:	N Pond	S Pond	Total
Aggregate, cubic yards:	10,944,000	10,093,000	21,037,000
Rip-rap, cubic yards:	226,000	264,000	490,000
Total, cubic yards:	11,170,000	10,357,000	21,527,000

Years for construction period:	4
Cubic Yards per Year:	5,381,750
Typical Load Density, tons/cubic yard:	1.5
Tons per Year:	8,072,625
Work Days per Year:	250
Haul Truck Capacity (tons):	100
Daily Truck Loads:	323
Empty Truck Weight (tons):	60

FUGITIVE DUST PARAMETERS:

silt+clay fraction =	5	percent
precipitation days =	15	days per year
dust control effect =	65	percent
Round trip time:	3.5	hours
Required haul trucks:	113	for 10-hour day

TYPE OF VEHICLE OR ITEM	NUMBER OF VEHICLES (if known)	1-WAY ROUTE DISTANCE (MILES)	TOTAL 1-WAY TRIPS PER DAY	ACTIVE USE DAYS PER YEAR	ANNUAL VMT ON UNPAVED ROADS	GROSS VEHICLE WEIGHT (tons)	NUMBER OF WHEELS	AVERAGE DRIVING SPEED (mph)	TONS OF FUGITIVE PARTICULATE MATTER PER YEAR
	OPTIONAL DATA FOR VMT CALCULATIONS								
CONSTRUCTION WORKER VEHICLES	440	2	880	250	440,000	3.5	4	15	101.1
WATER TRUCK (2,500 gallons)		18	20	250	90,000	29.0	8	10	85.7
100-TON OFF-ROAD HAULER, LOADED	113	18	323	250	1,453,500	160.0	6	10	3,960.0
100-TON OFF-ROAD HAULER, EMPTY	113	18	323	250	1,453,500	60.0	6	15	2,989.5
HEAVY EQUIPMENT TRANSPORTERS, LOADED		2	20	5	200	92.0	12	10	0.5
HEAVY EQUIPMENT TRANSPORTERS, EMPTY		2	20	5	200	60.0	12	15	0.6
ANNUAL TOTALS									7,137.4

Notes: Emission estimates are for total particulate matter emissions
VMT = vehicle miles traveled
Fugitive dust calculations are based on EPA unpaved road equations in AP-42 (Volume I, Section 13.2.2):
Tons/year = (1.0*5.9*((silt+clay)/12)*(speed/30)*((gvw/3)^0.7)*((wheels/4)^0.5)*(annual vmt)*
((365-precip days)/365)*((100-control)/100)/2000

TABLE C-47. DEFAULT SETTLING/DEPOSITION VELOCITIES FOR FUGITIVE DUST EMISSIONS: PARTICLE DENSITY OF 2.00 gm/cubic

Particle Size Fractions, Aerodynamic Diameter	Mass Fraction	Mass-Median Diameter (microns)	Default Reflection Coefficient	Default Deposition Coefficient	Settling Rate (meters/sec)	Settling Rate (cm/sec)	Deposition Rate (cm/sec)
1 - 5 Microns	0.01250	3.39	0.96385	0.03615	0.00067	0.06712	0.00243
5 - 10 Microns	0.02250	7.77	0.89038	0.10962	0.00352	0.35217	0.03861
10 - 15 Microns	0.04000	12.66	0.78599	0.21401	0.00936	0.93604	0.20032
15 - 20 Microns	0.05500	17.62	0.71449	0.28551	0.01812	1.81153	0.51720
20 - 25 Microns	0.08000	22.59	0.67142	0.32858	0.02979	2.97878	0.97876
25 - 30 Microns	0.09500	27.58	0.63539	0.36461	0.04438	4.43782	1.61809
30 - 40 Microns	0.12000	35.24	0.56602	0.43398	0.07246	7.24613	3.14467
40 - 50 Microns	0.10500	45.18	0.45070	0.54930	0.11915	11.91512	6.54502
50 - 60 Microns	0.09250	55.15	0.30654	0.69346	0.17751	17.75126	12.30972
60 - 70 Microns	0.07750	65.13	0.13356	0.86644	0.24755	24.75459	21.44833
70 - 80 Microns	0.06500	75.11	0.00000	1.00000	0.32925	32.92512	32.92512
80 - 90 Microns	0.05750	85.10	0.00000	1.00000	0.42263	42.26286	42.26286
90 - 100 Microns	0.05000	95.09	0.00000	1.00000	0.52768	52.76781	52.76781
100 - 110 Microns	0.04000	105.08	0.00000	1.00000	0.64440	64.43997	64.43997
110 - 120 Microns	0.03000	115.07	0.00000	1.00000	0.77279	77.27934	77.27934
120 - 130 Microns	0.02000	125.07	0.00000	1.00000	0.91286	91.28593	91.28593
130 - 140 Microns	0.01500	135.06	0.00000	1.00000	1.06460	106.45973	106.45973
140 - 150 Microns	0.01000	145.06	0.00000	1.00000	1.22801	122.80074	122.80074
150 - 160 Microns	0.00750	155.05	0.00000	1.00000	1.40309	140.30897	140.30897
160 - 170 Microns	0.00500	165.05	0.00000	1.00000	1.58984	158.98442	158.98442
WEIGHTED AVERAGES:		55.39	0.37085	0.62915	0.25089	25.08931	22.73734
FOR MEAN AEROSOL SIZE:		55.39	0.30654	0.69346	0.17751	17.75126	12.30972

Notes: Mass-median diameter and settling rate equations from ISC model user's guide (Wagner 1987).
Reflection coefficient formula based on regression analysis of data points scaled from Figure 2-8 in the ISC model user's guide (Wagner 1987).
Default reflection and deposition coefficients are most appropriate for solid particles; coefficients ignored for liquid aerosols.

ASSUMED MASS DISTRIBUTION

FUGITIVE DUST FROM HAUL ROADS

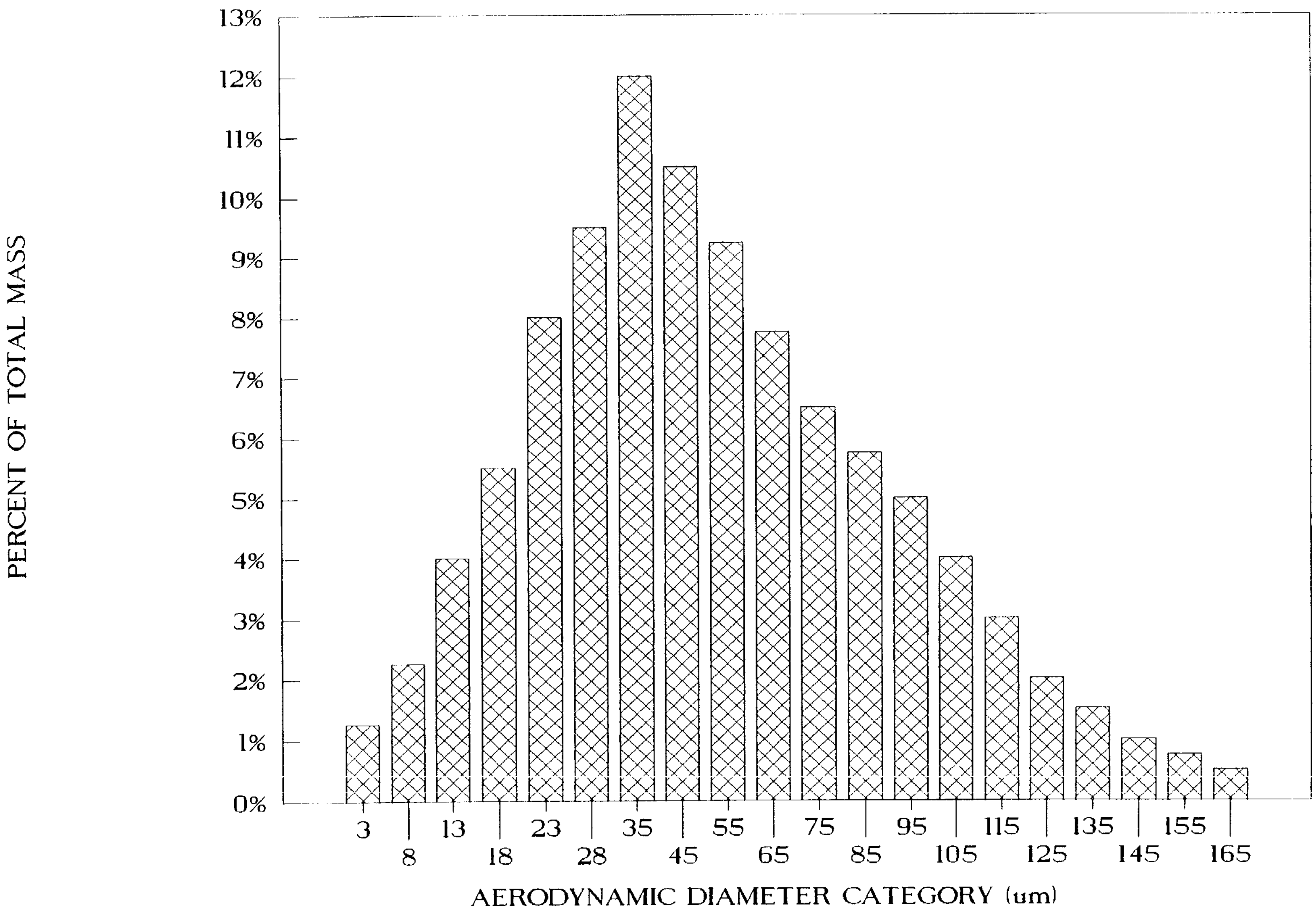


TABLE C-48. ESTIMATED MAXIMUM PM10 CONCENTRATIONS GENERATED BY TRUCK TRAFFIC ON THE HAUL ROAD FOR ALTERNATIVE 1

RESULTS FOR A WIND SPEED OF 1 METER PER SECOND AND NEUTRAL (CLASS D) STABILITY:

AVERAGING	PM10 CONCENTRATION (micrograms per cubic meter) AT VARIOUS DISTANCES (feet) FROM THE HAUL ROAD																					
TIME	50	100	150	200	300	400	500	600	700	800	900	1000	1250	1500	2000	2500	3000	3500	4000	4500	5000	6000
1-HOUR	3,558	2,232	1,721	1,425	1,067	887	773	683	608	545	491	449	373	323	262	226	200	180	164	152	144	130
10-HOURS	3,025	1,897	1,463	1,211	907	754	657	580	516	463	417	382	317	274	223	192	170	153	139	129	122	111
24-HOURS	1,512	949	731	606	453	377	328	290	258	231	209	191	158	137	111	96	85	77	70	64	61	55
BACKGROUND	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
24-HR TOTAL	1,562	999	781	656	503	427	378	340	308	281	259	241	208	187	161	146	135	127	120	114	111	105

RESULTS FOR A WIND SPEED OF 3 METERS PER SECOND AND NEUTRAL (CLASS D) STABILITY:

AVERAGING	PM10 CONCENTRATION (micrograms per cubic meter) AT VARIOUS DISTANCES (feet) FROM THE HAUL ROAD																					
TIME	50	100	150	200	300	400	500	600	700	800	900	1000	1250	1500	2000	2500	3000	3500	4000	4500	5000	6000
1-HOUR	1,397	852	647	532	403	329	280	245	219	201	186	174	150	132	105	87	77	68	61	55	51	47
10-HOURS	1,187	724	550	452	342	280	238	208	186	171	158	148	127	112	89	74	65	58	52	47	44	40
24-HOURS	594	362	275	226	171	140	119	104	93	85	79	74	64	56	44	37	33	29	26	24	22	20
BACKGROUND	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
24-HR TOTAL	644	412	325	276	221	190	169	154	143	135	129	124	114	106	94	87	83	79	76	74	72	70

TABLE C-48. ESTIMATED MAXIMUM PM10 CONCENTRATIONS GENERATED BY TRUCK TRAFFIC ON THE HAUL ROAD FOR ALTERNATIVE 1

Notes: Modeling analyses were performed with the CALINE4 dispersion model, assuming a 30,000-foot (5.68 miles) straight roadway alignment with receptors points perpendicular to the midpoint of the roadway segment. Wind directions were rotated in 10 degree increments to identify maximum concentrations at each receptor distance.

Neutral (Class D) stability conditions and a wind fluctuation (sigma theta) parameter of 20 degrees were assumed for all conditions.

The modeling analysis assumed a 1-hour traffic volume of 67 heavy trucks and an hourly PM10 emission rate of 767 grams (1.69 pounds) per vehicle-mile traveled.

To provide a conservative analysis, PM10 emissions were modeled without any particle settling or deposition.

A wind speed of 1 meter per second (2.2 mph) represents unfavorable meteorological conditions. A wind speed of 3 meters per second (6.7 mph) represents average wind speed conditions.

Worst case wind directions varied from 10 degrees off-axis close to the road to 40 degrees off-axis at distances of 4,500 feet or more from the road.

The maximum 10-hour average PM10 concentration is estimated as 85% of the maximum 1-hour average.

The maximum 24-hour average PM10 concentration is calculated for a 10-hour work day (no haul road traffic for the remaining hours).

The background 24-hour PM10 concentration is based on approximate annual average PM10 values for Westmoreland and Brawley.

The federal 24-hour PM10 standard is 150 micrograms per cubic meter. The state 24-hour PM10 standard is 50 micrograms per cubic meter.

TABLE C-49. ESTIMATED MAXIMUM TSP CONCENTRATIONS GENERATED BY TRUCK TRAFFIC ON THE HAUL ROAD FOR ALTERNATIVE 1

RESULTS FOR A WIND SPEED OF 1 METER PER SECOND AND NEUTRAL (CLASS D) STABILITY:

AVERAGING	TSP CONCENTRATION (micrograms per cubic meter) AT VARIOUS DISTANCES (feet) FROM THE HAUL ROAD																					
TIME	50	100	150	200	300	400	500	600	700	800	900	1000	1250	1500	2000	2500	3000	3500	4000	4500	5000	6000
1-HOUR	7,446	4,316	3,244	2,593	1,882	1,474	1,195	1,013	889	785	694	625	500	412	303	237	192	159	133	114	99	76
10-HOURS	6,329	3,669	2,757	2,204	1,600	1,252	1,015	861	755	667	590	531	425	350	257	202	163	135	113	97	84	65
24-HOURS	3,165	1,834	1,379	1,102	800	626	508	431	378	333	295	266	213	175	129	101	81	67	57	48	42	32
BACKGROUND	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24-HR TOTAL	3,265	1,934	1,479	1,202	900	726	608	531	478	433	395	366	313	275	229	201	181	167	157	148	142	132

RESULTS FOR A WIND SPEED OF 3 METERS PER SECOND AND NEUTRAL (CLASS D) STABILITY:

AVERAGING	TSP CONCENTRATION (micrograms per cubic meter) AT VARIOUS DISTANCES (feet) FROM THE HAUL ROAD																					
TIME	50	100	150	200	300	400	500	600	700	800	900	1000	1250	1500	2000	2500	3000	3500	4000	4500	5000	6000
1-HOUR	3,614	2,226	1,689	1,385	1,041	845	714	629	566	515	475	441	375	326	254	214	186	162	143	130	120	107
10-HOURS	3,072	1,892	1,436	1,178	885	718	607	535	481	438	403	375	319	277	216	182	158	137	121	110	102	91
24-HOURS	1,536	946	718	589	442	359	303	267	240	219	202	187	160	139	108	91	79	69	61	55	51	45
BACKGROUND	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
24-HR TOTAL	1,636	1,046	818	689	542	459	403	367	340	319	302	287	260	239	208	191	179	169	161	155	151	145

TABLE C-49. ESTIMATED MAXIMUM TSP CONCENTRATIONS GENERATED BY TRUCK TRAFFIC ON THE HAUL ROAD FOR ALTERNATIVE 1

Notes: Modeling analyses were performed with the CALINE4 dispersion model, assuming a 30,000-foot (5.68 miles) straight roadway alignment with receptors points perpendicular to the midpoint of the roadway segment. Wind directions were rotated in 10 degree increments to identify maximum concentrations at each receptor distance.

Neutral (Class D) stability conditions and a wind fluctuation (sigma theta) parameter of 20 degrees were assumed for all conditions.

The modeling analysis assumed a 1-hour traffic volume of 67 heavy trucks and an hourly TSP emission rate of 2,130 grams (4.7 pounds) per vehicle-mile traveled.

TSP emissions were modeled with a particle settling rate of 7.25 cm/second and a particle deposition rate of 3.14 cm/second.

A wind speed of 1 meter per second (2.2 mph) represents unfavorable meteorological conditions. A wind speed of 3 meters per second (6.7 mph) represents average wind speed conditions.

Worst case wind directions varied from 10 degrees off-axis close to the road to 40 degrees off-axis at distances of 4,500 feet or more from the road.

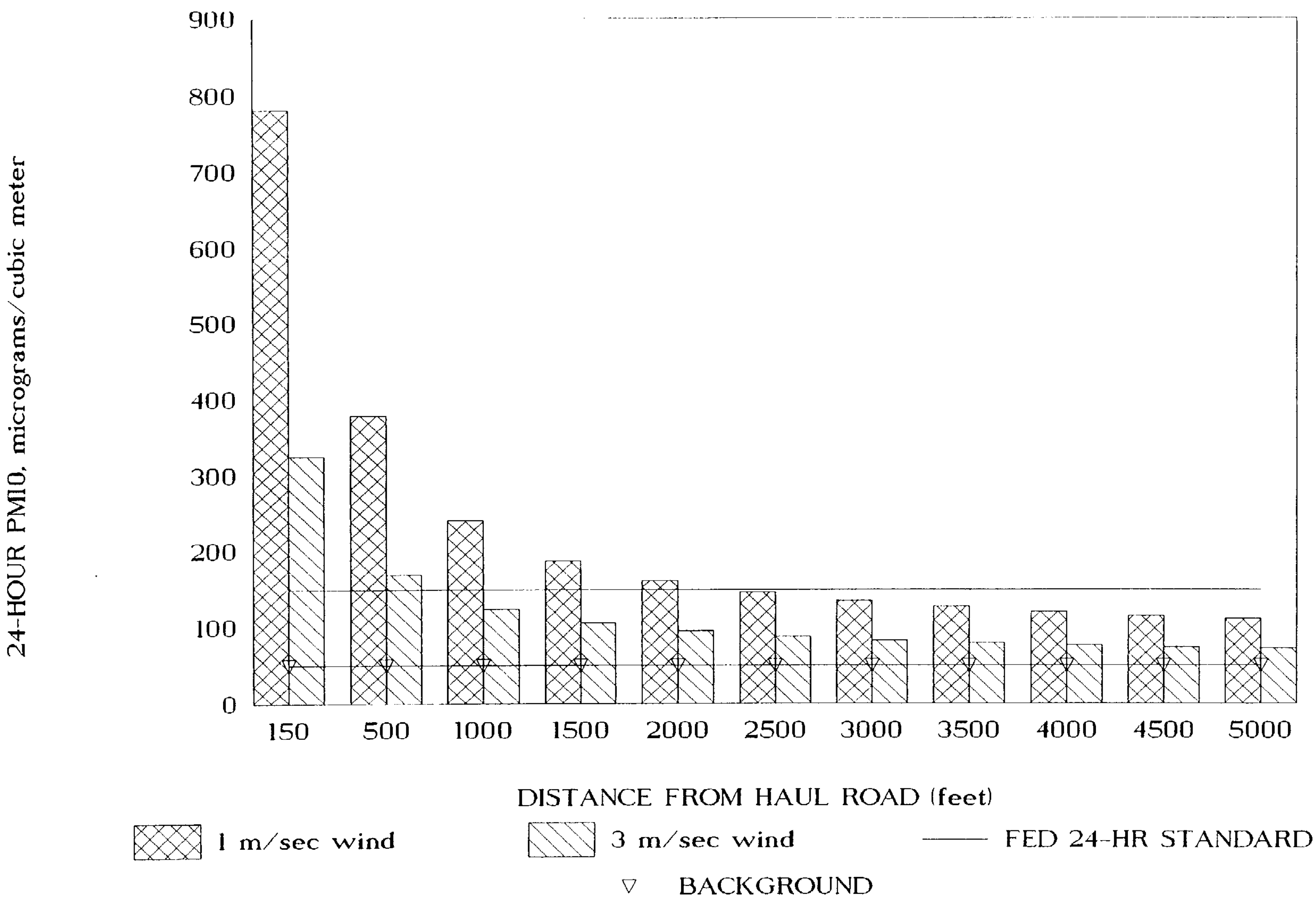
The maximum 10-hour average TSP concentration is estimated as 85% of the maximum 1-hour average.

The maximum 24-hour average TSP concentration is calculated for a 10-hour work day (no haul road traffic for the remaining hours).

The background 24-hour TSP concentration is assumed to be twice annual average PM10 concentration for Westmoreland and Brawley.

MAXIMUM PM10 IMPACT FROM HAUL ROAD

INCLUDING BACKGROUND CONCENTRATIONS



SALTON SEA LEVELS AND SALINITY

TABLE C-50. EXISTING MIX OF MAJOR SALT IONS IN THE SALTON SEA

WATER QUALTIY PARAMETER	AVERAGE mg/L	SUM OF ATOMIC WEIGHTS	MOLAR EQUIVALENTS	ANION & CATION BALANCES	ANION & CATION RATIOS
CHLORIDE	16,332	35.4527	460.7	79.13%	921.5
SULFATE	11,236	96.0636	117.0	20.09%	234.0
BICARBONATE	246	61.01714	4.0	0.69%	8.1
CARBONATE	30	60.0092	0.5	0.09%	1.0
SODIUM	12,114	22.989768	526.9	85.62%	81.8
MAGNESIUM	1,384	24.305	56.9	9.25%	8.8
CALCIUM	1,006	40.078	25.1	4.08%	3.9
POTASSIUM	252	39.0983	6.4	1.05%	1.0
SUM OF MAJOR ANIONS:			582.2		
SUM OF MAJOR CATIONS:			615.4		
CHLORIDE:SULFATE RATIO:			3.94		

Notes: Dissolved ion concentrations from Holdren 1999.

TABLE C-51. ESTIMATED SALTON SEA DENSITY VERSUS SALINITY RELATIONSHIPS

NOMINAL SALINITY PERCENT	PARTS PER 1000, 20 deg C	SALTON SEA DENSITY ADJUSTMENT	RELATIVE DENSITY (kg/liter)	SPECIFIC GRAVITY, 20 deg C	GRAMS/TOTAL LITER SALT	GRAMS/TOTAL LITER WATER	DISPLACED WATER (gm/liter)
0.5%	4.94	0.9954	0.9972	0.9990	5.0	996.9	1.33
1.0%	9.92	0.9954	1.0010	1.0028	10.1	995.5	2.73
1.5%	14.91	0.9954	1.0047	1.0065	15.1	994.1	4.13
2.0%	19.89	0.9954	1.0085	1.0103	20.3	992.7	5.53
2.5%	24.87	0.9954	1.0123	1.0141	25.4	991.2	7.03
3.0%	29.86	0.9954	1.0160	1.0178	30.6	989.7	8.53
3.5%	34.84	0.9954	1.0197	1.0216	35.8	988.1	10.13
4.0%	39.82	0.9954	1.0235	1.0253	41.1	986.6	11.63
4.5%	44.81	0.9954	1.0272	1.0290	46.4	985.0	13.23
5.0%	49.79	0.9954	1.0310	1.0328	51.8	983.3	14.93
5.5%	54.78	0.9954	1.0348	1.0366	57.1	981.6	16.63
6.0%	59.76	0.9954	1.0386	1.0404	62.5	979.9	18.33
6.5%	64.74	0.9954	1.0423	1.0442	68.0	978.1	20.13
7.0%	69.73	0.9954	1.0460	1.0479	73.5	976.3	21.93
7.5%	74.71	0.9954	1.0498	1.0517	79.0	974.6	23.63
8.0%	79.69	0.9954	1.0536	1.0555	84.6	972.9	25.33
8.5%	84.68	0.9954	1.0574	1.0592	90.2	971.2	27.03
9.0%	89.66	0.9954	1.0612	1.0631	95.9	969.3	28.93
9.5%	94.64	0.9954	1.0650	1.0669	101.6	967.5	30.73
10.0%	99.63	0.9954	1.0678	1.0697	107.3	965.6	32.63
10.5%	104.6	0.9950	1.0717	1.0736	113.1	963.7	34.58
11.0%	109.6	0.9946	1.0756	1.0775	118.9	961.7	36.53
11.5%	114.6	0.9943	1.0790	1.0810	124.8	959.8	38.48
12.0%	119.6	0.9939	1.0825	1.0844	130.6	957.8	40.43
12.5%	124.6	0.9936	1.0859	1.0878	136.6	955.8	42.48
13.0%	129.5	0.9932	1.0893	1.0913	142.5	953.7	44.53
13.5%	134.5	0.9928	1.0928	1.0947	148.6	951.6	46.63
14.0%	139.5	0.9925	1.0962	1.0981	154.6	949.5	48.73
14.5%	144.5	0.9921	1.0996	1.1016	160.7	947.4	50.88
15.0%	149.5	0.9918	1.1030	1.1050	166.8	945.2	53.03
16.0%	159.7	0.9910	1.1102	1.1121	179.2	940.6	57.67
17.0%	169.7	0.9903	1.1172	1.1192	191.8	935.7	62.51
18.0%	179.7	0.9896	1.1244	1.1264	204.5	930.6	67.64
19.0%	189.7	0.9889	1.1316	1.1336	217.4	925.1	73.11
20.0%	199.6	0.9882	1.1388	1.1409	230.5	919.3	78.96
21.0%	209.6	0.9875	1.1462	1.1482	243.7	913.0	85.26
22.0%	219.6	0.9867	1.1536	1.1556	257.1	906.2	92.07
23.0%	229.6	0.9860	1.1611	1.1631	270.7	898.8	99.44
24.0%	239.6	0.9853	1.1686	1.1707	284.5	890.8	107.46
25.0%	249.6	0.9846	1.1763	1.1784	298.4	882.0	116.19
26.0%	259.5	0.9839	1.1840	1.1861	312.5	872.5	125.73
27.0%	269.5	0.9832	1.1919	1.1940	326.8	862.1	136.14
28.0%	279.5	0.9824	1.1998	1.2019	341.3	850.7	147.53
29.0%	289.5	0.9817	1.2078	1.2099	355.9	838.2	159.99

TABLE C-51. ESTIMATED SALTON SEA DENSITY VERSUS SALINITY RELATIONSHIPS

NOMINAL SALINITY PERCENT	PARTS PER 1000, 20 deg C	SALTON SEA DENSITY ADJUSTMENT	RELATIVE DENSITY (kg/liter)	SPECIFIC GRAVITY, 20 deg C	GRAMS/TOTAL LITER SALT	GRAMS/TOTAL LITER WATER	DISPLACED WATER (gm/liter)
30.0%	299.5	0.9810	1.2159	1.2181	370.8	824.6	173.62
31.0%	309.5	0.9810	1.2250	1.2272	385.8	809.7	188.51
32.0%	319.4	0.9810	1.2343	1.2365	401.0	793.4	204.79
33.0%	329.4	0.9810	1.2436	1.2458	416.4	775.7	222.56
34.0%	339.4	0.9810	1.2531	1.2553	431.9	756.3	241.95
35.0%	349.4	0.9810	1.2627	1.2650	447.7	735.2	263.08
36.0%	359.4	0.9810	1.2725	1.2747	463.6	712.2	286.07
37.0%	369.3	0.9810	1.2823	1.2846	479.7	687.2	311.06
38.0%	379.3	0.9810	1.2923	1.2946	496.0	660.0	338.19
39.0%	389.3	0.9810	1.3025	1.3048	512.5	630.6	367.60
40.0%	399.3	0.9810	1.3128	1.3151	529.2	598.8	399.43
41.0%	409.3	0.9810	1.3232	1.3255	546.1	564.4	433.85
42.0%	419.3	0.9810	1.3338	1.3361	563.2	527.2	471.00
43.0%	429.2	0.9810	1.3445	1.3468	580.4	487.2	511.06
44.0%	439.2	0.9810	1.3553	1.3577	597.9	444.1	554.18
45.0%	449.2	0.9810	1.3663	1.3688	615.5	397.7	600.54
46.0%	459.2	0.9810	1.3775	1.3799	633.3	347.9	650.31
47.0%	469.2	0.9810	1.3888	1.3913	651.3	294.5	703.68
48.0%	479.2	0.9810	1.4003	1.4028	669.5	237.4	760.84
49.0%	489.1	0.9810	1.4119	1.4144	687.9	176.3	821.96
50.0%	499.1	0.9810	1.4237	1.4262	706.5	111.0	887.26
51.0%	509.1	0.9810	1.4357	1.4382	725.2	41.3	956.92

Data and calcualtions are based on ocean water, with adjustments for other types of saline waters being made to the relative density and specific gravity columns.
Most data for nominal salinities of up to 15% are from the sea water aqueous solution table (page D-258) in Weast (1980).
Relative densities for ocean water are adjusted to Salton Sea conditions based on comparative specific gravity estimates at 4.5% and 35% salinities (Ormat estimates for Salton Sea, calculations with this spreadsheet for ocean water).
Specific gravity and displaced water quantities are calculated from other data in the table (density of water is 998.23 grams per liter at 20 degrees C, 1,000 grams/liter at 4 deg C).
Grams of salt in solution, displaced water quantities, and relative densities for nominal salinities above 15% are calculated based on regression analyses (TABLECURVE 2D software) using data for lower salinities. Regression analyses are used to calculate nominal relative densities of ocean water because relative densities listed in Weast (1980) do not equal the sum of salt plus water grams per liter.
Grams of water in solution, salinity parts per thousand, and specific gravity for nominal salinities above 15% are calculated from other values.
Calculations for nominal salinties above 30% are somewhat artificial, since many salts will reach saturation concentration at lower total salinity levels.

Data Source: Weast, Robert C. (ed.). 1980. CRC Handbook of Chemistry and Physics. 61st Edition. CRC Press. Boca Raton, FL.

TABLE C-52. COMPARISON OF OWENS LAKE, MONO LAKE, AND SALTON SEA

FEATURE	OWENS LAKE	MONO LAKE	SALTON SEA
CURRENT LAKE SURFACE ELEVATION	3,553+/- feet for residual brine pool.	6,380+/- feet; water levels now rising.	-227 feet.
LAKE BASIN PREHISTORY	Long prehistory of periodic lake formation and dessication. Historic Owens Lake present from Pleistocene times until dessication in 1926.	Very ancient prehistory without any evidence of natural dessication. Lake may have existed continuously for more than 750,000 years.	Prehistory of periodic lake formation and dessication. Last deep natural lake dessicated about 300 - 500 years ago. Subsequent history of shallow temporary lakes formed by irregular Colorado River overflows.
LAKE BASIN SHAPE AND DRAINAGE CONTEXT	Shallow, flat depression. Terminal basin for surface flows. Under natural conditions, probably a terminal basin for groundwater flows. May have transformed into a groundwater recharge area due to groundwater pumping. Pre-diversion period maximum depth: 30 - 35 feet; deeper during high stands.	Deep bowl. Terminal basin for both surface and groundwater flows. Pre-diversion period maximum depth: about 185 feet; deeper during high stands.	Elongated valley. Terminal basin for surface flows. Status as terminal basin or recharge area for groundwater flows unclear. Current maximum depth: about 50 feet. Natural surface and groundwater flows insufficient to create a natural lake.
NATURAL SURFACE INFLOWS	Owens River plus small local streams.	Rush Creek, Lee Vining Creek, Mill Creek, and other Sierra streams.	Periodic Colorado River overflows. Seasonal flows in local rivers and creeks.
ARTIFICIAL SURFACE INFLOWS	Minimal.	Minimal (storm drainage from Lee Vining area).	Significant agricultural drainage flows.

TABLE C-52. COMPARISON OF OWENS LAKE, MONO LAKE, AND SALTON SEA

FEATURE	OWENS LAKE	MONO LAKE	SALTON SEA
NATURAL GROUNDWATER INFLOWS	Natural springs (some with artesian flow). Presumably, some groundwater inflow from north along Owens River channel. Other shallow groundwater inflows?	Natural springs (mostly non-saline, some with artesian flow). Non-saline groundwater from west and south; saline groundwater from north and east.	Presumably minimal under natural conditions. Agricultural irrigation may have augmented natural groundwater flows or created new groundwater flows.
WATER CHEMISTRY	Saline, alkaline, and sulfurous. High phosphate levels. Obvious influence from volcanic deposits in watershed (including high arsenic and cadmium levels).	Saline, alkaline, and sulfurous. High phosphate levels. Obvious influence from volcanic deposits in watershed (high boron, fluoride, arsenic, strontium, and lithium levels).	Saline and sulfurous. Sulfate content has increased somewhat faster than chloride content since 1907. Other chemical influences mostly from agricultural chemicals.
MAJOR DISSOLVED SALTS	Sodium chloride, sodium carbonate, sodium sulfate, sodium bicarbonate. Calcium carbonate deposition under natural conditions.	Sodium carbonate, sodium chloride, sodium sulfate. Significant calcium carbonate deposition under natural conditions.	Sodium chloride, magnesium chloride, sodium sulfate, sodium bicarbonate. Calcium carbonate and calcium sulfate deposition occurring?
WATER TEMPERATURES	Seasonal cycle probably below 25 deg C prior to dessication.	Seasonal cycle of 3 - 22 deg C at 2 meters.	Seasonal cycle of 15 - 30 deg C in most years.
PRE-INTERFERENCE SALINITY LEVELS	1866-1886: 6.5% - 10% 1905-1912: 9.6% - 21.4% Owens River diverted in 1917.	1941: 4.8% Major creeks diverted starting in 1941.	1907: 0.36% 1914: 1.14% 1929: about 3.3% 1960: about 3.6% 1970: about 3.9% 1999: 4.4%

TABLE C-52. COMPARISON OF OWENS LAKE, MONO LAKE, AND SALTON SEA

FEATURE	OWENS LAKE	MONO LAKE	SALTON SEA
POST-INTERFERENCE SALINITY	Lake dessicated between 1917 and 1926. Saturated brine pool remains.	1990: 9%. Salinity probably declining as lake levels rise.	7.5% in 2030 under No Action, lowest inflow. Otherwise, below 5.4%.
FATE OF DISSOLVED SALTS WITH INTERFERENCE	Different salts reached saturation in 1920 and 1921. Sequential precipitatation of salts. Brine within salt bed at saturation. 40% loss of 1912 salt load from the system; sodium chloride removal by groundwater movement suspected.	Salts have remained in solution. No salt deposition from Mono Lake itself.	Salts will remain in solution. No salt deposition expected within the forseeable future, even with inflows reduced to 800,000 acre-feet per year.
EXTENT AND SOURCE OF CURRENT SALT DEPOSITS	Massive salt deposits on lake bed, derived as precipitates from dessicating lake. Complex spatial mixtures of sodium chloride, sodium carbonate, sodium bicarbonate, and sodium sulfate salts; calcium carbonate also in bottom of deposit. Gradual shrinking of main salt bed area. Ongoing process of evaporative salt formation (mostly sulfate, carbonate, bicarbonate salts) and redissolving, mostly around eastern and southern sides of salt deposit. Presence of efflorescent salts indicates shallow saline groundwater along eastern and southern sides of lakebed.	Extensive salt deposits on north and east shore, above lake level. Salt deposits are evaporative deposits derived from saline groundwater, and formed only after the lake level was lowered below the natural zone of groundwater inflow to Mono Lake. Mineralogical phase changes in deposits indicate dominance by sodium carbonate, sodium bicarbonate, and sodium sulfate salts; sodium chloride probably present in some areas.	Historically, central salt pans left by dessication of temporary lakes (redissolved when flooded again). Currently, a narrow zone of shoreline salt deposits as would be expected around any saline lake. Deposits probably dominated by chloride salts having low inherent susceptibility to wind erosion. No evidence of significant salt deposits susceptible to wind erosion.

TABLE C-52. COMPARISON OF OWENS LAKE, MONO LAKE, AND SALTON SEA

FEATURE	OWENS LAKE	MONO LAKE	SALTON SEA
WIND EROSION HAZARD FOR CURRENT SALT DEPOSITS	Varies from very low (wet deposits and deposits dominated by sodium chloride) to very high (dryer sodium carbonate, sodium bicarbonate, and sodium sulfate deposits; these undergo mineralogical phase changes from nonerosive crystalline forms to noncrystalline, anhydrous powders that are extremely erosive).	Varies from very low (wet deposits) to very high (dryer sodium carbonate, sodium bicarbonate, and sodium sulfate deposits; these undergo mineralogical phase changes from nonerosive crystalline forms to noncrystalline, anhydrous powders that are extremely erosive).	Mostly low to very low (sodium chloride deposits and crusted soils). Relatively high water temperatures during most of the year indicate that sodium chloride (low wind erosion hazard) will precipitate with or before sulfate and carbonate salts, should the Salton Sea ever dessicate.
WIND EROSION HAZARD FOR OTHER SEDIMENTS AND SOILS	Mostly low emission rates, typical of desert basin soils.	Mostly low emission rates, typical of desert basin soils. Very low erosion hazard for exposed tufa deposits and basaltic sands. Moderate erosion hazards for sands derived from pumice. Very high erosion hazard for exposed diatomaceous sediments on Paoha Island.	Mostly low emission rates, typical of desert basin soils. Comparative emission rates for agricultural areas uncertain.

ENHANCED EVAPORATION SYSTEM EVALUATION

TABLE C-53. ENHANCED EVAPORATION SYSTEM LAYOUT ASSUMPTIONS FOR DISPERSION MODELING PURPOSES

PHYSICAL LAYOUT OF EACH MODULE:

EACH MODULE A 3-POND, 2-PASS SPRAY SYSTEM WITH LINEAR TOWER ARRAYS PARALLEL TO LENGTH OF POND (WIDTH OF OVERALL MODULE):

	MODULE COMPONENTS		SPRAY SYSTEM COMPONENTS														POND AREA	
POND TYPE	LENGTH (feet)	WIDTH (feet)	LINES PER ARRAY	LINE MEMBER SPACING (feet)	LINE ARRAY WIDTH (feet)	GAP BETWEEN LINE ARRAYS (feet)	LINE ARRAYS IN POND	TOWER SPACING (feet)	TOWERS PER LINE ARRAY	CONNECT ZONE PER SIDE OF TOWER (feet)	ACTIVE SEGMENTS PER LINE ARRAY	TOTAL ACTIVE SPRAY LENGTH (feet)	BUFFER AT END OF ARRAY (feet)	OVERALL ARRAY LENGTH (feet)	OUTER LINE ARRAY BUFFER (feet)	LINE ARRAY HEIGHT (feet)	SQ FEET	ACRES
Second Pass	1,200	806	5	10	40	120	5	500	3	5	2	980	100	1,000	83	82	967,200	22.20
First Pass	1,200	672	5	10	40	120	4	500	3	5	2	980	100	1,000	96	131	806,400	18.51
Final Pond	1,200	806															967,200	22.20
MODULE:	1,200	2,284															2,740,800	62.92

Input parameters: Pond length and width; lines per array; line member spacing; tower spacing; connect zone per side of tower; line array height.

Gap between line arrays assumed to be 3 times the line array width.

All other parameters calculated directly from input parameters.

Basic Module Configuration:

```
          |----------------|
|<----   |  second pass   |
|  |->   |   spray pond   |
|  |     |----------------|
|  |     |   first pass   | <=== inflow
|  |<-   |   spray pond   |
|        |----------------|
|---->   |   final salt   |
         |      pond      |
         |----------------|
```

NUMBER OF MODULES:

75 for Phase 1

125 for Phase 2

TABLE C-54. WATER AND SALT FLOW RATES FOR LINE ARRAYS IN A MODULE

FLOWS FOR EACH FIRST PASS LINE ARRAY IN A MODULE
ESTIMATED FIRST PASS EVAPORATION FACTOR 63.5%

TOTAL FIRST PASS ACRE-FT PER YEAR	TOTAL FIRST PASS ACRE-FT PER DAY	WATER VOLUME AND MASS FOR EACH LINE ARRAY: ACRE-FT PER DAY	GALLONS PER DAY	GALLONS PER HR	GALLONS PER MIN	POUNDS PER HR	POUNDS PER MIN	INITIAL SALT CONTENT	SALT RELEASE PER LINE ARRAY: POUNDS PER HR	POUNDS PER MIN	FIRST PASS SALT EMISSIONS GM/HR/MILE OF LINE	OUTLFOW SALT CONTENT	MEAN DROPLET DENSITY (gm/cm^3)
2,000	5.48	1.37	446,372	18,599	310.0	159,207	2,653	4.3%	6,846	114.10	1.640E+07	11.0%	1.0487

NOZZLE SPACING ALONG LINES IN ARRAY: 9 FEET (= nozzle spray pattern diameter)
PER NOZZLE FLOW RATE (gal/min): 0.57 GAL/MIN

FLOWS FOR EACH SECOND PASS LINE ARRAY IN A MODULE:
ESTIMATED SECOND PASS CUMULATIVE EVAPORATION FACTOR: 87.2%
SECOND PASS INCREMENTAL EVAPORATION FACTOR: 64.9%

TOTAL SECOND PASS ACRE-FT PER YEAR	TOTAL SECOND PASS ACRE-FT PER DAY	WATER VOLUME AND MASS FOR EACH LINE ARRAY: AC-FT PER DAY	GALLONS PER DAY	GALLONS PER HR	GALLONS PER MIN	POUNDS PER HR	POUNDS PER MIN	INFLOW SALT CONTENT	SALT RELEASE PER LINE ARRAY: POUNDS PER HR	POUNDS PER MIN	SECOND PASS SALT EMISSIONS GM/HR/MILE OF LINE	OUTLFOW SALT CONTENT	MEAN DROPLET DENSITY (gm/cm^3)
751	2.06	0.41	134,081	5,587	93.1	49,966	833	11.0%	5,496	91.60	1.316E+07	26.0%	1.1279

NOZZLE SPACING ALONG LINES IN ARRAY: 9 FEET (= nozzle spray pattern diameter)
PER NOZZLE FLOW RATE (gal/min): 0.17 GAL/MIN

Line source emission rates computed using the gross array length of 1,000 feet (as opposed to the active spray length of 980 feet).

TABLE C-55. LINE SOURCE COORDINATE GUIDE FOR DISPERSION MODELING

RELATIVE COORDINATES FOR FIRST/LAST ARRAYS:		TOWER 1 X1	TOWER 1 Y1	TOWER 2 X2	TOWER 2 Y2	TOWER 3 X3	TOWER 3 Y3	NOZZLE SPRAY DIAMETER	5-LINE SOURCE WIDTH	OVERALL ARRAY LENGTH	COMBINED ARRAY WIDTH
Second Pass Module:	top array of lines	100	2201	600	2201	1100	2201	9	54		
	spacing between line arrays	0	-160	0	-160	0	-160				
	bottom array of lines	100	1561	600	1561	1100	1561	9	54	1,000	640
First Pass Module:	top array of lines	100	1395	600	1395	1100	1395	9	54		
	spacing between line arrays	0	-160	0	-160	0	-160				
	bottom array of lines	100	902	600	902	1100	902	9	54	1,000	493

Nozzle spray pattern diameter = line spacing in array - 1 foot
Modeled line source width = overall line array spray width = line array width + 2*(1/2 nozzle spray diameter) + 5 feet for line sway.
Relative coordinate system origin set at bottom left corner of module.

```
(0,2284) |---------------|(1200,2284)
         |  second pass  |
         |  spray pond   |
(0,1478) |---------------|(1200,1478)
         |  first pass   |
         |  spray pond   |
 (0,806) |---------------|(1200,806)
         |  final salt   |
         |     pond      |
   (0,0) |---------------|(1200,0)
```

TABLE C-56. LOOKUP TABLE FOR DATA ASSOCIATED WITH FIRST PASS OR CUMULATIVE EVAPORATION

	NOMINAL PERCENT EVAP	POUNDS PER HOUR			NOMINAL SALINITY	KG PER LITER	POUNDS PER GAL	% OF INITIAL VOLUME
		TOTAL	WATER	SALT				
INITIAL CONDITIONS:		159,207	152,361	6,846	4.3%	1.0257	8.5600	100.0%
WATER CONTENT EVAPORATION FACTOR:	0.0%	159,207	152,361	6,846	4.3%	1.0257	8.5600	100.0%
	5.0%	151,589	144,743	6,846	4.5%	1.0272	8.5724	95.1%
	10.0%	143,971	137,125	6,846	4.8%	1.0295	8.5914	90.1%
	15.0%	136,353	129,507	6,846	5.0%	1.0310	8.6041	85.2%
	20.0%	128,735	121,889	6,846	5.3%	1.0333	8.6231	80.3%
	25.0%	121,117	114,271	6,846	5.7%	1.0363	8.6485	75.3%
	30.0%	113,499	106,653	6,846	6.0%	1.0386	8.6675	70.4%
	35.0%	105,881	99,035	6,846	6.5%	1.0423	8.6984	65.4%
	40.0%	98,262	91,417	6,846	7.0%	1.0460	8.7293	60.5%
	45.0%	90,644	83,799	6,846	7.6%	1.0506	8.7673	55.6%
	50.0%	83,026	76,180	6,846	8.2%	1.0551	8.8054	50.7%
	55.0%	75,408	68,562	6,846	9.1%	1.0620	8.8625	45.7%
	60.0%	67,790	60,944	6,846	10.1%	1.0686	8.9177	40.9%
	63.5%	62,458	55,612	6,846	11.0%	1.0717	8.9438	37.5%
	65.0%	60,172	53,326	6,846	11.4%	1.0783	8.9990	36.0%
	67.5%	56,363	49,517	6,846	12.1%	1.0832	9.0396	33.5%
	70.0%	52,554	45,708	6,846	13.0%	1.0893	9.0906	31.1%
	72.5%	48,745	41,899	6,846	14.0%	1.0962	9.1482	28.6%
	75.0%	44,936	38,090	6,846	15.2%	1.1044	9.2170	26.2%
	77.5%	41,127	34,281	6,846	16.6%	1.1144	9.3001	23.8%
	80.0%	37,318	30,472	6,846	18.3%	1.1266	9.4016	21.3%
	82.5%	33,509	26,663	6,846	20.4%	1.1418	9.5284	18.9%
	85.0%	29,700	22,854	6,846	23.1%	1.1619	9.6961	16.5%
	87.2%	26,348	19,502	6,846	26.0%	1.1840	9.8810	14.3%
	90.0%	22,082	15,236	6,846	31.0%	1.2250	10.2231	11.6%
	92.5%	18,273	11,427	6,846	37.5%	1.2873	10.7430	9.1%

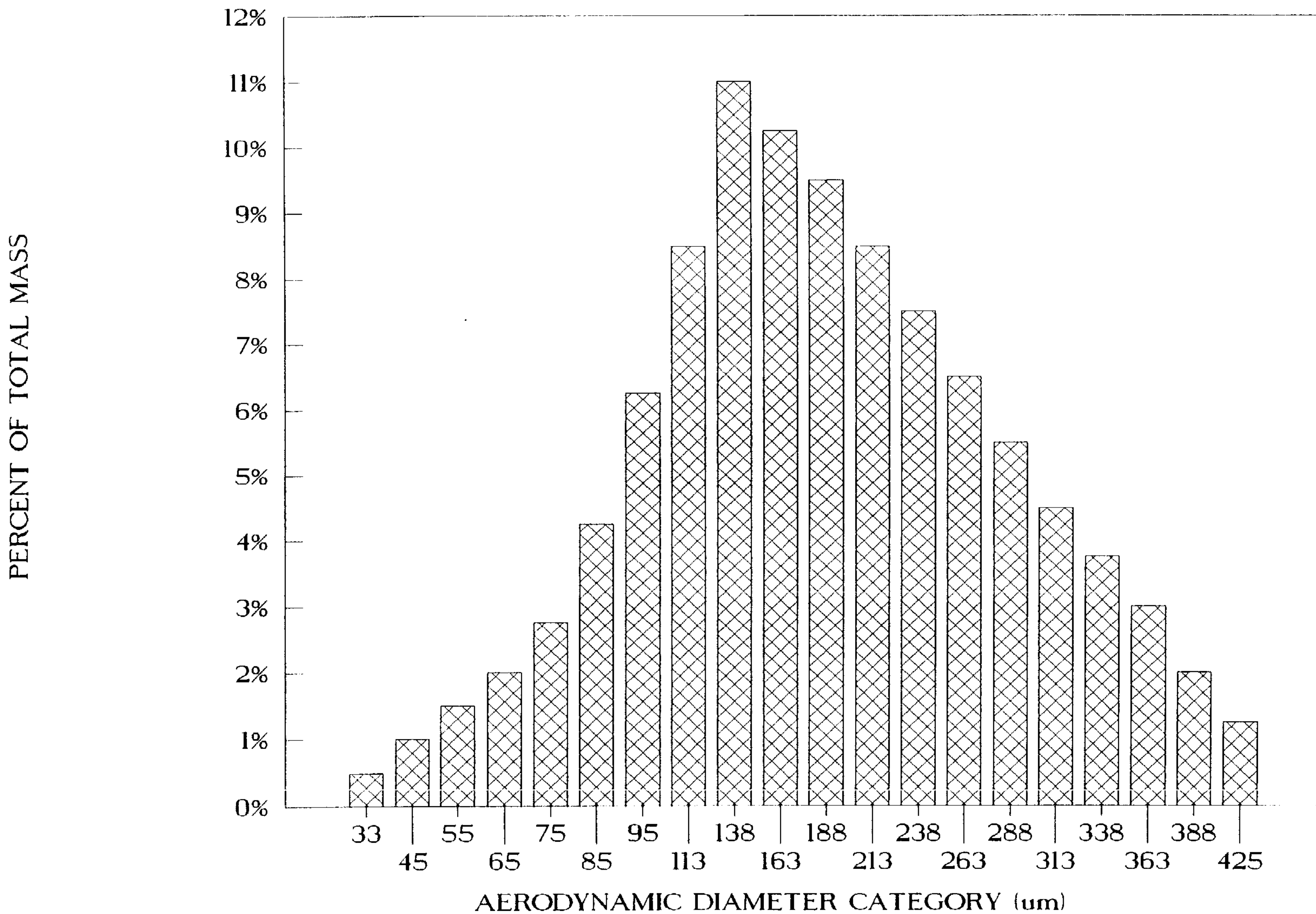
TABLE C-57. SPRAY DROPLET SETTLING/DEPOSITION RATES FOR FIRST PASS ARRAYS

Spray Droplet Size Categories, Aerodynamic Diameter	Mass Fraction	Mass-Median Diameter (microns)	Default Reflection Coefficient	Default Deposition Coefficient	Settling Rate (meters/sec)	Settling Rate (cm/sec)	Deposition Rate (cm/sec)
25 - 40 Microns	0.00500	33.07	0.66235	0.33765	0.03346	3.34604	3.34604
40 - 50 Microns	0.01000	45.18	0.59068	0.40932	0.06248	6.24769	6.24769
50 - 60 Microns	0.01500	55.15	0.51510	0.48490	0.09308	9.30788	9.30788
60 - 70 Microns	0.02000	65.13	0.42439	0.57561	0.12980	12.98007	12.98007
70 - 80 Microns	0.02750	75.11	0.31857	0.68143	0.17264	17.26429	17.26429
80 - 90 Microns	0.04250	85.10	0.19763	0.80237	0.22161	22.16053	22.16053
90 - 100 Microns	0.06250	95.09	0.06158	0.93842	0.27669	27.66880	27.66880
100 - 125 Microns	0.08500	112.96	0.00000	1.00000	0.39048	39.04809	39.04809
125 - 150 Microns	0.11000	137.88	0.00000	1.00000	0.58174	58.17422	58.17422
150 - 175 Microns	0.10250	162.82	0.00000	1.00000	0.81125	81.12544	81.12544
175 - 200 Microns	0.09500	187.78	0.00000	1.00000	1.07902	107.90180	107.90180
200 - 225 Microns	0.08500	212.74	0.00000	1.00000	1.38503	138.50332	138.50332
225 - 250 Microns	0.07500	237.72	0.00000	1.00000	1.72930	172.93000	172.93000
250 - 275 Microns	0.06500	262.70	0.00000	1.00000	2.11182	211.18185	211.18185
275 - 300 Microns	0.05500	287.68	0.00000	1.00000	2.53259	253.25889	253.25889
300 - 325 Microns	0.04500	312.67	0.00000	1.00000	2.99161	299.16110	299.16110
325 - 350 Microns	0.03750	337.65	0.00000	1.00000	3.48888	348.88849	348.88849
350 - 375 Microns	0.03000	362.64	0.00000	1.00000	4.02441	402.44106	402.44106
375 - 400 Microns	0.02000	387.63	0.00000	1.00000	4.59819	459.81881	459.81881
400 - 450 Microns	0.01250	425.49	0.00000	1.00000	5.54013	554.01326	554.01326
WEIGHTED AVERAGE VALUES:		193.16	0.04644	0.95356	1.39048	139.04753	139.04753
FOR MEAN AEROSOL CATEGORY:		187.78	0.00000	1.00000	1.07902	107.90180	107.90180
FOR WEIGHTED AVERAGE SIZE:		193.16	0.00000	1.00000	1.14178	114.17772	114.17772

Notes: Mass-median diameter and settling rate equations from ISC model user's guide (Wagner 1987).
Reflection coefficient from regression analysis of data points scaled from Figure 2-8 in Wagner (1987).
Default reflection and deposition coefficients are most appropriate for solid particles; coefficients are ignored for liquid aerosols.
Spray droplet size range based on size range for mist and drizzle droplets.
Mass distribution weighted toward small mist droplets for maximum evaporation.
Mean droplet density of 1.0487 gm/cubic cm based on Salton Sea water evaporated to about 7.36% salinity.

ASSUMED MASS DISTRIBUTION

ENHANCED EVAPORATION SYSTEM DROPLETS



DROPLET SETTLING/DEPOSITION RATES

FIRST PASS SPRAY IN EES MODULES

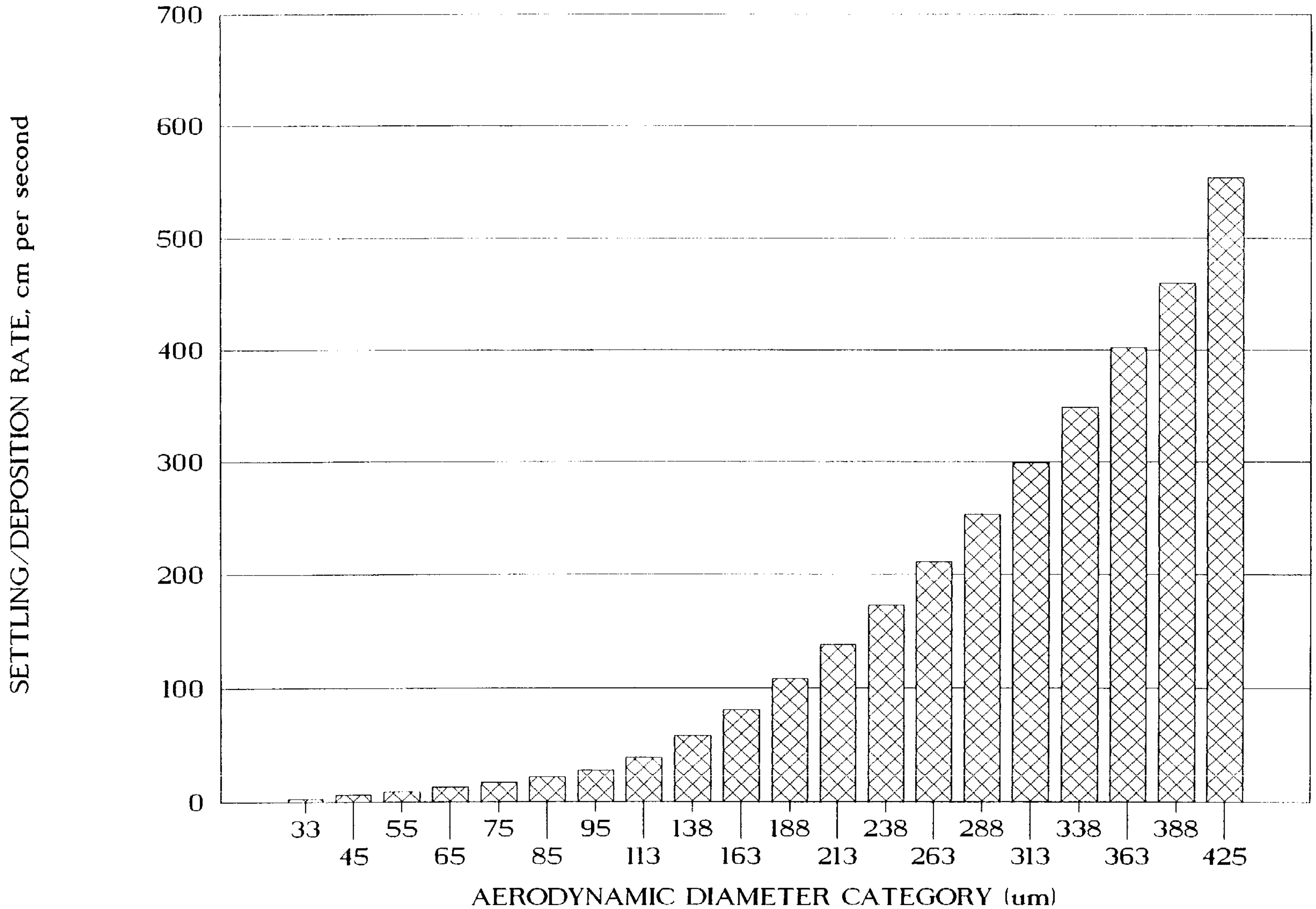


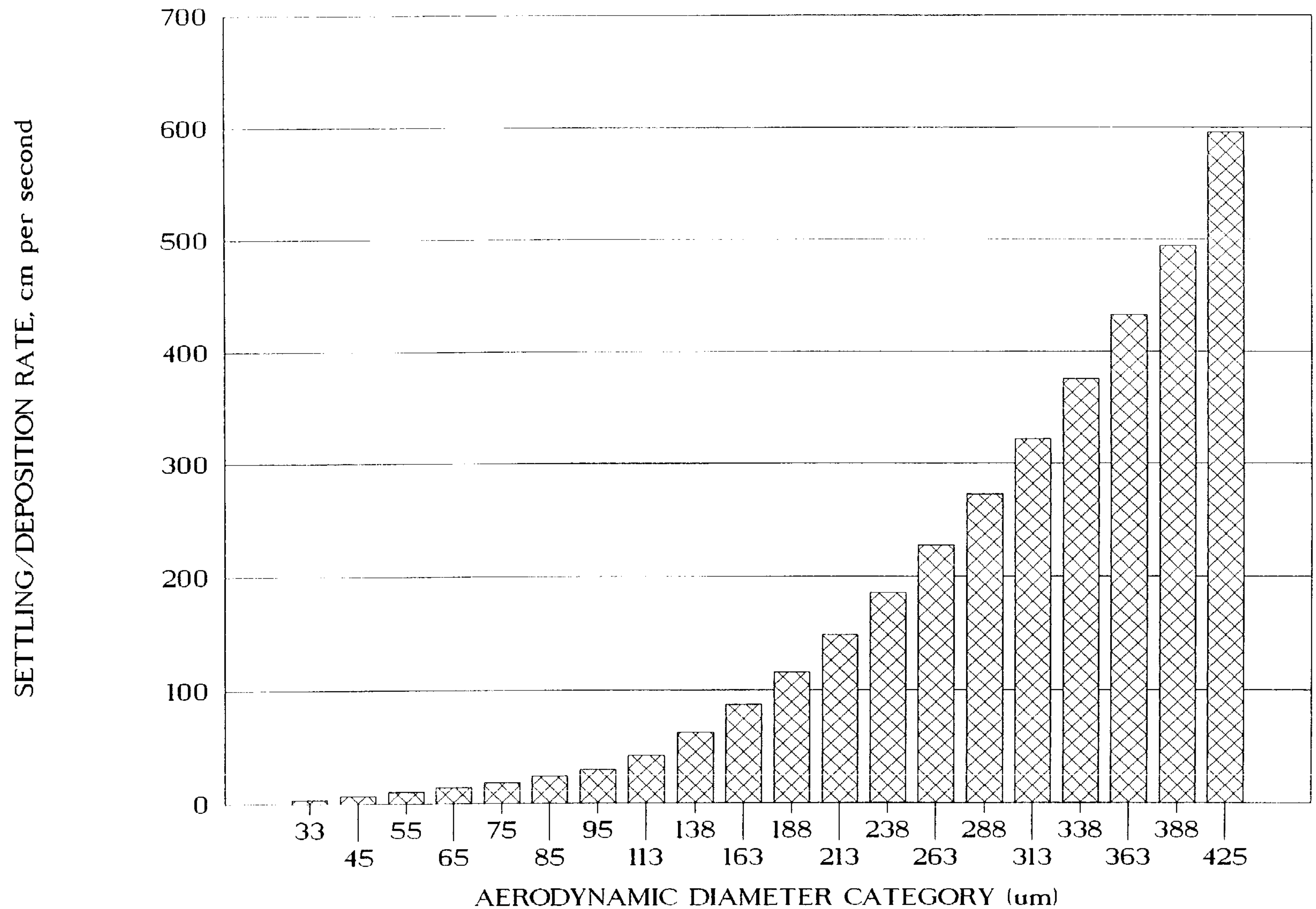
TABLE C-58. SPRAY DROPLET SETTLING/DEPOSITION RATES FOR SECOND PASS ARRAYS

Spray Droplet Size Categories, Aerodynamic Diameter	Mass Fraction	Mass-Median Diameter (microns)	Default Reflection Coefficient	Default Deposition Coefficient	Settling Rate (meters/sec)	Settling Rate (cm/sec)	Deposition Rate (cm/sec)
25 - 40 Microns	0.00500	33.07	0.65611	0.34389	0.03599	3.59874	3.59874
40 - 50 Microns	0.01000	45.18	0.57903	0.42097	0.06720	6.71953	6.71953
50 - 60 Microns	0.01500	55.15	0.49773	0.50227	0.10011	10.01083	10.01083
60 - 70 Microns	0.02000	65.13	0.40018	0.59982	0.13960	13.96035	13.96035
70 - 80 Microns	0.02750	75.11	0.28637	0.71363	0.18568	18.56812	18.56812
80 - 90 Microns	0.04250	85.10	0.15630	0.84370	0.23834	23.83414	23.83414
90 - 100 Microns	0.06250	95.09	0.00997	0.99003	0.29758	29.75840	29.75840
100 - 125 Microns	0.08500	112.96	0.00000	1.00000	0.41997	41.99708	41.99708
125 - 150 Microns	0.11000	137.88	0.00000	1.00000	0.62568	62.56766	62.56766
150 - 175 Microns	0.10250	162.82	0.00000	1.00000	0.87252	87.25220	87.25220
175 - 200 Microns	0.09500	187.78	0.00000	1.00000	1.16051	116.05077	116.05077
200 - 225 Microns	0.08500	212.74	0.00000	1.00000	1.48963	148.96337	148.96337
225 - 250 Microns	0.07500	237.72	0.00000	1.00000	1.85990	185.99003	185.99003
250 - 275 Microns	0.06500	262.70	0.00000	1.00000	2.27131	227.13075	227.13075
275 - 300 Microns	0.05500	287.68	0.00000	1.00000	2.72386	272.38552	272.38552
300 - 325 Microns	0.04500	312.67	0.00000	1.00000	3.21754	321.75436	321.75436
325 - 350 Microns	0.03750	337.65	0.00000	1.00000	3.75237	375.23727	375.23727
350 - 375 Microns	0.03000	362.64	0.00000	1.00000	4.32834	432.83424	432.83424
375 - 400 Microns	0.02000	387.63	0.00000	1.00000	4.94545	494.54528	494.54528
400 - 450 Microns	0.01250	425.49	0.00000	1.00000	5.95853	595.85349	595.85349
WEIGHTED AVERAGE VALUES:		193.16	0.03968	0.96032	1.49549	149.54869	149.54869
FOR MEAN AEROSOL CATEGORY:		187.78	0.00000	1.00000	1.16051	116.05077	116.05077
FOR WEIGHTED AVERAGE SIZE:		193.16	0.00000	1.00000	1.22801	122.80065	122.80065

Notes: Mass-median diameter and settling rate equations from ISC model user's guide (Wagner 1987).
Reflection coefficient from regression analysis of data points scaled from Figure 2-8 in Wagner (1987).
Default reflection and deposition coefficients are most appropriate for solid particles; coefficients are ignored for liquid aerosols.
Spray droplet size range based on size range for mist and drizzle droplets.
Mass distribution weighted toward small mist droplets for maximum evaporation.
Mean droplet density of 1.1279 gm/cubic cm based on Salton Sea water evaporated to 18.49% salinity.

DROPLET SETTLING/DEPOSITION RATES

SECOND PASS SPRAY IN EES MODULES



APPENDIX D
VISUAL CONTRAST WORKSHEETS

Visual Contrast Rating Worksheet - D.1

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name:	Salton Sea Restoration Project
Critical Viewpoint Number:	#1, Salton City
VRM Class:	Class II Objective
Location:	Looking east from the shoreline

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. Land/Water

Form:	Prominent linear shoreline and sea; mountain backdrop in distant background
Line:	Horizontal shoreline and sea; vertical mountains in distant background
Color:	Light beige sand in immediate foreground; deep blue sea in middleground; blue-gray mountains in background
Texture:	Sparse and smooth in foreground/middleground; coarse in background

2. Vegetation

Form:	None
Line:	None
Color:	None
Texture:	None

3. Structure

Form:	None
Line:	None
Color:	None
Texture:	None

C. PROPOSED ACTIVITY DESCRIPTION: Evaporation Ponds (Alternatives 1, 4, and 5)

1. Land/Water

Form:	Flat
Line:	Low, horizontal
Color:	Blue
Texture:	Smooth

2. Vegetation

Form:	None
Line:	None
Color:	None
Texture:	None

3. Structure

Form:	Long, linear dike
Line:	Bold, horizontal
Color:	Gray concrete
Texture:	Slightly coarse effect

D. CONTRAST RATING ● Long Term

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (None) 0 (None) 0 (None) 0	4 0 0 0 4	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Moderate) 2 (Moderate) 2 (Moderate) 2	8 3 4 2 17	30

1a. Maximum element contrast: Moderate
1b. Maximum feature contrast: 17 (Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.2

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #2, State Route 86
VRM Class: Class II Objective
Location: Looking east from the west side of State Route 86 at the entrance to the Salton Sea Test Base and location of proposed haul road intersection

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Flat, linear terrain; mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountain slopes in background
   - **Color:** Light-medium gray pavement in foreground; light-beige sand and dark land cover in foreground/middleground; blue-gray mountains
   - **Texture:** Sparse and coarse

2. **Vegetation**
   - **Form:** Patches of shrubs in foreground/middleground
   - **Line:** Weak and diffuse
   - **Color:** Brownish, olive green
   - **Texture:** Sparse, mottled, uneven, and coarse

3. **Structure**
   - **Form:** Sparse linear signage
   - **Line:** Vertical posts, polygon sign faces
   - **Color:** Red and yellow
   - **Texture:** Sparse and uneven; coarse

C. PROPOSED ACTIVITY DESCRIPTION: EES Facility at Salton Sea Test Base (Alternatives 3,4, and 5)

1. **Land/Water**
   - **Form:** Fluid, amorphous (spraying effect), sporadic (not always operating)
   - **Line:** Vertical, complex silhouette
   - **Color:** Vertical, complex silhouette
   - **Texture:** Fine grain, directional

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

3. Structure

Form: Large, horizontal blocks of precipitation ponds; prominent complex tower assemblages

Line: Strong irregular lines created by edge effect of linear towers and horizontal ponds

Color: Concrete gray ponds and towers, black hoses

Texture: Coarse

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Moderate) 2 (Moderate) 2 (Moderate) 2	8 6 4 2 20	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Strong) 3 (Strong) 3 (Moderate) 2 (Moderate) 2	12 9 4 2 27	30

1a. Maximum element contrast: Strong

1b. Maximum feature contrast: 27 (Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.3

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #3, Dos Palmos Reserve
VRM Class: Class II Objective
Location: Looking south

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Flat, linear terrain, gently rolling
   - **Line:** Horizontal
   - **Color:** Light-beige sand in foreground; light- to medium-tans and darker green land cover; deep green field in middleground
   - **Texture:** Sparse and coarse elsewhere

2. **Vegetation**
   - **Form:** Scattered low shrubs in foreground/middleground
   - **Line:** Weak and diffuse
   - **Color:** light- to medium tan, greens
   - **Texture:** Coarse

3. **Structure**
   - **Form:** Linear transmission line towers in middleground/background
   - **Line:** Weak, vertical lines, regularly spaced
   - **Color:** Blue-gray color; visible against light blue sky background
   - **Texture:** Fine and sparse, even pattern

C. PROPOSED ACTIVITY DESCRIPTION: EES Facility at Salton Sea Test Facility (Alternatives 3,4, and 5)

1. **Land/Water**
   - **Form:** Fluid, amorphous (spraying effect), sporadic (not always operating)
   - **Line:** Vertical, complex silhouette
   - **Color:** Blue-gray
   - **Texture:** Fine grain, directional

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

3. Structure

Form: Horizontal blocks of precipitation ponds; prominent complex tower assemblages

Line: Irregular lines created by edge effect of linear towers and horizontal ponds

Color: Concrete gray ponds and towers, black hoses

Texture: Coarse

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Weak) 1 (None) 0 (Moderate) 2	8 3 0 2 13	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Moderate) 2 (Moderate) 2 (Moderate) 2	8 6 4 2 20	30

1a. Maximum element contrast: Moderate

1b. Maximum feature contrast: 20 (Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.4

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #4, Communities of Lark Spa and Fountain of Youth
VRM Class: Class II Objective
Location: Looking northwest, towards the Orocopia Mountains

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Flat, linear terrain; slightly undulating roadway; dramatic prominent mountain backdrop in distance background
   - **Line:** Horizontal terrain; bold contrasting roadway band; jagged mountain peaks in background
   - **Color:** Gray pavement in foreground; light-beige sand and blue-gray mountains in background
   - **Texture:** Smooth in immediate foreground (roadway); sparse and coarse elsewhere

2. **Vegetation**
   - **Form:** Small patches of shrubs in foreground/middleground
   - **Line:** Weak and diffuse
   - **Color:** Dark green
   - **Texture:** Dense clusters in middleground

3. **Structure**
   - **Form:** Linear transmission line towers barely visible in background
   - **Line:** Weak, vertical lines, regularly spaced
   - **Color:** Blue-gray color; blends into existing mountain backdrop
   - **Texture:** Fine and sparse, even pattern

C. PROPOSED ACTIVITY DESCRIPTION: EES Facility at Bombay Beach (Alternative 2)

1. **Land/Water**
   - **Form:** Fluid, amorphous (spraying effect), sporadic (not always operating)
   - **Line:** Vertical, complex silhouette
   - **Color:** Blue-gray
   - **Texture:** Fine grain, directional

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

3. Structure

Form: Horizontal blocks of precipitation ponds; prominent complex tower assemblages
Line: Irregular lines created by edge effect of linear towers and horizontal ponds
Color: Concrete gray ponds and towers, black hoses
Texture: Coarse

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (None) 0 (Weak) 1	4 3 0 1 8	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Moderate) 2 (Moderate) 2 (Weak) 1	8 6 4 1 19	30

1a. Maximum element contrast: Moderate
1b. Maximum feature contrast: 19 (Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.5

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #5, Red Hill Marina
VRM Class: Class II Objective
Location: Looking northwest

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Prominent linear shoreline and sea; mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountains in distant background
   - **Color:** Light beige sand in immediate foreground; blue sea in middleground; blue-gray mountains in background
   - **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. **Vegetation**
   - **Form:** Small patches of shrubs
   - **Line:** Horizontal
   - **Color:** Tans, dark green
   - **Texture:** Dense, coarse clusters

3. **Structure**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: Evaporation Ponds (Alternatives 1, 4, and 5)

1. **Land/Water**
   - **Form:** Flat
   - **Line:** Low, horizontal
   - **Color:** Blue
   - **Texture:** Smooth

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** Long, linear dike
   - **Line:** Bold, horizontal
   - **Color:** Gray concrete
   - **Texture:** Slightly coarse effect

D. CONTRAST RATING ● Long Term

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (None) 0 (None) 0 (None) 0	4 0 0 0 4	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (Weak) 1 (Weak) 1	4 3 2 1 10	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 10 (Structures)

2. Does the design meet visual management resource requirements? Yes.

Visual Contrast Rating Worksheet - D.6

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #6, State Route 111
VRM Class: Class II Objective
Location: Looking east, towards the Chocolate and Orocopia Mountains

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Flat, linear terrain; dramatic prominent mountain backdrops in distance background
   - **Line:** Horizontal; jagged mountain peaks in background
   - **Color:** Bright, light-beige sand in foreground, tan and blue-gray mountains in background
   - **Texture:** Smooth in immediate foreground (roadway); sparse and coarse elsewhere

2. **Vegetation**
   - **Form:** Sparse, small patches of shrubs in foreground/middleground
   - **Line:** Weak and diffuse
   - **Color:** tans, dark green
   - **Texture:** Sporadic clusters in foreground/middleground

3. **Structure**
   - **Form:** Linear transmission line poles and lines prominent in foreground; other towers and lines barely visible in background
   - **Line:** Vertical and horizontal elements, regularly spaced
   - **Color:** Dark brown poles; blue-gray lines spanning poles less visible against sky backdrop
   - **Texture:** Fine and sparse, even pattern

C. PROPOSED ACTIVITY DESCRIPTION: EES Facility at Bombay Beach (Alternative 2)

1. **Land/<u>Water</u>**
   - **Form:** Fluid, amorphous (spraying effect), sporadic (not always operating)
   - **Line:** Vertical, complex silhouette
   - **Color:** Blue-gray
   - **Texture:** Fine grain, directional

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

3. Structure

Form: Horizontal blocks of precipitation ponds; prominent complex tower assemblages

Line: Irregular lines created by edge effect of linear towers and horizontal ponds

Color: Concrete gray ponds and towers, black hoses

Texture: Coarse

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (Moderate) 2 (Weak) 1 (Moderate) 2	8 6 2 2 18	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Strong) 3 (Strong) 3 (Moderate) 2 (Strong) 3	12 9 4 3 28	30

1a. Maximum element contrast: Moderate
1b. Maximum feature contrast: 28 (Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.7

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #7, Torres Martinez Indian Reservation
VRM Class: Class II Objective
Location: Looking south, southeast

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. Land/Water

Form: Prominent linear shoreline and sea; mountain backdrop in distant background
Line: Horizontal; vertical mountains in distant background
Color: Light beige sand; blue sea in middleground; blue-gray mountains in background
Texture: Sparse and smooth in foreground/middleground; coarse in background

2. Vegetation

Form: Sparse, small patches of shrubs in foreground, dense clusters in middleground/background
Line: Irregular, horizontal
Color: Tans and dark green
Texture: Coarse

3. Structure

Form: None
Line: None
Color: None
Texture: None

C. PROPOSED ACTIVITY DESCRIPTION: Evaporation Ponds (Alternatives 1,4, and 5)

1. Land/Water

Form: Flat
Line: Low, horizontal
Color: Blue
Texture: Smooth

2. Vegetation

Form: None
Line: None
Color: None
Texture: None

3. Structure

Form: Long, linear dike
Line: Bold, horizontal
Color: Gray concrete
Texture: Slightly coarse effect

D. CONTRAST RATING ● Long Term

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (None) 0 (None) 0 (None) 0	4 0 0 0 4	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (Weak) 1 (None) 0	4 3 2 0 9	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 9 (Structures)

2. Does the design meet visual management resource requirements? Yes.

Visual Contrast Rating Worksheet - D.8

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #8, Desert Shores
VRM Class: Class II Objective
Location: Looking south, towards proposed haul road

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Prominent linear roadway (State Route 86); mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountains in distant background
   - **Color:** Gray roadway; blue-gray mountains in background
   - **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: Haul Road (Alternatives 1,4, and 5)

1. **Land/<u>Water</u>**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** Long, linear
   - **Line:** Low, horizontal
   - **Color:** Gray
   - **Texture:** Smooth

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of	Score	Maximum

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

		Contrast		Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (Weak) 1 (None) 0	4 3 2 0 9	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 9 (Structures)

2. Does the design meet visual management resource requirements? Yes.

Visual Contrast Rating Worksheet - D.9

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #5, Red Hill Marina
VRM Class: Class II Objective
Location: Looking northwest

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Prominent linear shoreline and sea; mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountains in distant background
   - **Color:** Light beige sand in immediate foreground; blue sea in middleground; blue-gray mountains in background
   - **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. **Vegetation**
   - **Form:** Small patches of shrubs
   - **Line:** Horizontal
   - **Color:** Tans, dark green
   - **Texture:** Dense, coarse clusters

3. **Structure**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: Displacement Pond (Alternatives 1, 2, 3, 4,and 5)

1. **Land/Water**
   - **Form:** Flat
   - **Line:** Low, horizontal
   - **Color:** Blue
   - **Texture:** Smooth

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** Long, linear dike
   - **Line:** Bold, horizontal
   - **Color:** Gray concrete
   - **Texture:** Slightly coarse effect

D. CONTRAST RATING ● Long Term

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(Moderate) 2 (None) 0 (None) 0 (None) 0	8 0 0 0 8	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Strong) 3 (Moderate) 2 (Weak) 1 (Weak) 1	12 6 2 1 21	30

1a. Maximum element contrast: Strong
1b. Maximum feature contrast: 21(Structures)

2. Does the design meet visual management resource requirements? No.

Visual Contrast Rating Worksheet - D.10

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #9, SR 68-segment from Salton Sea Test Base to southern tip of Salton Sea
VRM Class: Class II Objective
Location: Looking northwest

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Prominent linear shoreline and sea; mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountains in distant background
   - **Color:** Light beige sand in immediate foreground; blue sea in middleground; blue-gray mountains in background
   - **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. **Vegetation**
   - **Form:** Small patches of shrubs
   - **Line:** Horizontal
   - **Color:** Tans, dark green
   - **Texture:** Dense, coarse clusters

3. **Structure**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: Pupfish Pond (Alternatives 1, 2, 3, 4, 5)

1. **Land/<u>Water</u>**
   - **Form:** Flat
   - **Line:** Low, horizontal
   - **Color:** Blue
   - **Texture:** Smooth

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** Long, linear dike ("Z" shape)
   - **Line:** Bold, horizontal
   - **Color:** Gray/beize concrete
   - **Texture:** Slightly coarse effect

D. CONTRAST RATING ● Long Term

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (None) 0 (None) 0	4 3 0 0 7	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 7 (Structures)

2. Does the design meet visual management resource requirements? Yes.

Visual Contrast Rating Worksheet - D.11

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #10, SR 111- roadway segment closest to and between Bombay Beach and Mullet Island
VRM Class: Class II Objective
Location: Looking west

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. Land/Water
- **Form:** Prominent linear shoreline and sea; mountain backdrop in distant background
- **Line:** Horizontal; vertical mountains in distant background
- **Color:** Light beige sand in immediate foreground; blue sea in middleground; blue-gray mountains in background
- **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. Vegetation
- **Form:** Small patches of shrubs
- **Line:** Horizontal
- **Color:** Tans, dark green
- **Texture:** Dense, coarse clusters

3. Structure
- **Form:** None
- **Line:** None
- **Color:** None
- **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: Southeast Shorebird and Pupfish Protection Pond (Alternatives 1, 2, 3, 4, 5)

1. Land/Water
- **Form:** Flat
- **Line:** Low, horizontal
- **Color:** Blue
- **Texture:** Smooth

2. Vegetation
- **Form:** None
- **Line:** None
- **Color:** None
- **Texture:** None

3. Structure
- **Form:** Long, linear dike (“Z” shape)
- **Line:** Bold, horizontal
- **Color:** Gray/beize concrete
- **Texture:** Slightly coarse effect

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 0 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (None) 0 (None) 0	4 3 0 0 7	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 7 (Structures)

2. Does the design meet visual management resource requirements? Yes.

Visual Contrast Rating Worksheet - D.12

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

A. PROJECT INFORMATION

Project Name: Salton Sea Restoration Project
Critical Viewpoint Number: #7, Torres Martinez Indian Reservation
VRM Class: Class II Objective
Location: Looking south, southeast

B. CHARACTERISTIC LANDSCAPE DESCRIPTION

1. **Land/Water**
   - **Form:** Prominent linear shoreline and sea; mountain backdrop in distant background
   - **Line:** Horizontal; vertical mountains in distant background
   - **Color:** Light beige sand; blue sea in middleground; blue-gray mountains in background
   - **Texture:** Sparse and smooth in foreground/middleground; coarse in background

2. **Vegetation**
   - **Form:** Sparse, small patches of shrubs in foreground, dense clusters in middleground/background
   - **Line:** Irregular, horizontal
   - **Color:** Tans and dark green
   - **Texture:** Coarse

3. **Structure**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

C. PROPOSED ACTIVITY DESCRIPTION: North wetland habitat and pupfish protection Pond- Alternatives 1, 2, 3, 4, and 5)

1. **Land/<u>Water</u>**
   - **Form:** Flat
   - **Line:** Low, horizontal
   - **Color:** Blue
   - **Texture:** Smooth

2. **Vegetation**
   - **Form:** None
   - **Line:** None
   - **Color:** None
   - **Texture:** None

3. **Structure**
   - **Form:** Long, linear dike, “Z” shape
   - **Line:** Bold, horizontal
   - **Color:** Gray/beize concrete
   - **Texture:** Slightly coarse effect

Visual Contrast Rating Worksheet

Source: BLM Manual Section 6331 - Visual Resource Contrast Rating

D. CONTRAST RATING ● Long Term

Feature	Element	Degree of Contrast	Score	Maximum Possible Score
Land/Water Surface	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 <u>0</u> 0	30
Vegetation	Form - 4x Line - 3x Color - 2x Texture - 1x	(None) 0 (None) 0 (None) 0 (None) 0	0 0 0 <u>0</u> 0	30
Structures	Form - 4x Line - 3x Color - 2x Texture - 1x	(Weak) 1 (Weak) 1 (None) 0 (None) 0	4 3 0 <u>0</u> 7	30

1a. Maximum element contrast: Weak
1b. Maximum feature contrast: 7 (Structures)

2. Does the design meet visual management resource requirements? Yes.

APPENDIX E
CULTURAL BACKGROUND OF THE SALTON SEA AREA

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The following is a brief summary of the cultural background of the Salton Sea region. A more detailed presentation of this information is provided within the Salton Sea Cultural Resources Class 1 Survey Report (Smith et al. 1999).

E.1 PRE-CONTACT HISTORY

The pre-contact history of the Salton Sea basin can be characterized into three general periods: the Paleoindian, the Archaic, and the Patayan. Brief summaries of these periods are presented here.

The Paleoindian Period lasted from approximately 10,000 to 7,000 years before present (BP), and represented a hunting-gathering lifestyle focusing on Pleistocene megafauna. This period is manifested in the Colorado Desert by the San Dieguito complex. This technological complex describes an assemblage of bifaces, choppers, scrapers, crescents, and other tools associated with a hunting-gathering economy. Three separate phases are represented in this complex, each reflecting a developmental sequence toward increasing technological complexity and diversity. Sites from this period are generally lithic scatters or rock features on the surface of deflated desert pavements, near major drainage areas, or along the shorelines of Pleistocene lakes (Apple et al. 1997).

The Archaic Period is characterized as a more diverse hunting-gathering tradition, which lasted from approximately 7,000 to 1,200 years BP. This period is poorly represented in the Colorado Desert region, and Hayden (1976) suggests that this area may have been largely abandoned due to warm and dry conditions characterizing the Middle Holocene. Sites dating from the Archaic also may have been eliminated by natural site formation processes or obscured by later settlements (M. Weide 1976). The ephemeral evidence currently suggests Archaic Period hunting-gathering populations with affinities to the Pinto Basin Complex (Moratto 1984). Excavated sites, in combination with radiocarbon dates and a burial recovered in Truckhaven (Barker et al. 1973), provides some indication that this area was not completely abandoned during the Archaic Period. In rockshelter deposits, larger points indicative of the Archaic Period are gradually replaced by Cottonwood Triangular and Desert Side-notched points, which, along with the presence of pottery, are clear indications of the cultural transition to the Patayan Period.

The Patayan Period began after 1,200 years BP and lasted until the first Spanish explorers reached the area. Most archaeological sites identified near the Salton Sea have been from the Patayan Period, yet the Patayan are still considered one of the least understood Southwestern prehistoric cultures (Reid and Whittlesey 1997). The Patayan have been characterized as small dispersed groups who were exceptionally mobile. It is believed that pottery techniques and floodplain agriculture were adopted from Mexican groups who traveled or traded up the Colorado River (Rogers 1945). A shift in burial patterns from internments to cremations also is considered characteristic of this general cultural transition.

The Patayan Period has been separated into three phases that characterize changes in pottery types that coincide with the cyclic filling of Lake Cahuilla (Waters 1984). The Patayan I Phase (1,200 to 950 years BP) describes the beginning of a strong Patayan influence from western Arizona into the Colorado Desert (Waters 1982). This influence is evidenced by the occurrence of Buff and Brown pottery in common Patayan vessel forms, as well as the adoption of Cottonwood and Desert Side-notched projectile points (Moratto 1984).

The discontinuation of certain specific pottery traits and the subsequent adoption of new pottery characteristics mark the Patayan II Phase of the Colorado Desert, lasting from 950 to 450 years BP (Waters 1982). During this phase, Patayan pottery use expands rapidly to encompass the new shoreline of Lake Cahuilla, then filling much of the Salton Trough. Researchers have identified more than ten discrete pottery types from this phase. Subsistence patterns indicate a reliance on lacustrine (lake) resources to augment hunted game and gathered plant resources.

The Patayan III Phase of the Colorado Desert (450 years BP to European contact) is characterized by large population shifts triggered by the evaporation of Lake Cahuilla (Rogers 1945; Wilke 1978; Waters 1982). Colorado Buff becomes the principal pottery ware during this phase. Researchers have suggested that groups on the western side of Lake Cahuilla moved into the foothills and mountains of western California and Mexico (Waters 1982). Other groups may have moved to the Colorado River Valley and extended to the river delta (Rogers 1945). The Patayan Period ends with European contact and the accompanying post-contact cultural changes.

E.2 ETHNOHISTORY

There are nine linguistically and culturally distinct Native American groups known to have occupied the California portion of the Salton Sea basin. These groups include the Cahuilla, Cocopah, Cupeño, Digueño (Tipai/Kumeyaay/Ipai), Kamia, Mohave, Quechan, Serrano, and Southern Paiute (Chemehuevi). Several groups from Baja California also utilized resources from the study area including the Paipai, Kiliwa, and Ñakipa. Each of these groups is briefly discussed below.

E.2.1 Cahuilla

The Cahuilla territory was near the geographic center of southern California. The territory was bounded to the north by the San Bernardino Mountains, to the south by the Borrego Springs and the Chocolate Mountains, to the east by a portion of the Colorado Desert west of Orocopia Mountain, and to the west by the San Jacinto Plain near Riverside and the eastern slopes of Palomar Mountains. Cahuilla villages were near water sources in the canyons or on alluvial fans. The diversity of the territory provided the Cahuilla with a variety of foods, including acorns, mesquite, screw beans, piñon nuts, and various types of cacti. A marginal agricultural existence provided corn, beans, squashes, and melons. Rabbits and small animals were hunted to supplement the diet (Bean 1978). At the time of Spanish contact, the Cahuilla population numbered approximately 6,000. Their political and economic autonomy was maintained until 1877 when the federal government started to establish reservations in the area (Bean 1978).

E.2.2 Cocopah

The Cocopah lived in portions of the southwestern United States and Mexico along the Colorado River and its delta. The region provided a natural habitat for flora and fauna. A wide variety of fish, game, and vegetal foods was available, and the Cocopah planted corn, squash, and beans on a seasonal basis. Population estimates for the Cocopah at the time of Spanish contact numbered at least 5,000 to 6,000. The Gadsden Purchase in 1853 established an international boundary through what was Cocopah territory. In 1917 the government granted the Cocopah three small areas designated as reservation land. In 1974, enrolled membership of the American Cocopah numbered 504. In 1976, a total of 205 Cocopah lived in Baja California and Sonora (DeWilliams 1983).

E.2.3 Cupeño

The Cupeño occupied a small mountainous area approximately 10 miles in diameter, bordering the San Luis Rey River and Lake Henshaw. Approximately 750 people lived in two permanent villages within a broad open valley of San Jose de Valle. Each village maintained its own clan leader and was politically independent. The Cupeño diet included acorns, small seeds, berries, cactus fruit, deer, quail, rabbits, and other small animals (Bean and Smith 1978a). In the years following 1810, the Spanish began building *asistencias*, which were inland outposts of the coastal missions, and the settler's cattle grazed on Cupeño lands. Territorial conflicts over land and treatment of the clan members by the Europeans came to an end in the late 1800s when the Supreme Court ordered the Cupeños removed to Pala Reservation in Luiseño territory. It is estimated that the Cupeño population today numbers approximately 150 (Bean and Smith 1978a).

E.2.4 Digueño (Tipai/Kumeyaay/Ipai)

The Diegueño include three separate subgroups that are linguistically and culturally similar. Therefore, the three groups are discussed below under the category of Diequeño. The territory of the Diequeño extended north from Todos Santos Bay near

Ensenada, Mexico, to the mouth of the San Luis Rey River in the northern portion of San Diego County, and east to the Sand Hills bordering the Imperial Valley. The Tipai and Kumeyaay occupied the southern portion of the territory, while the Ipai inhabited the northern region. The primary source of subsistence was vegetal food. Seasonal travel followed the ripening of plants from the valley floor to higher elevations of the mountain slopes. Deer, rodents, and birds provided meat as a secondary source of sustenance. Families also gathered piñon nuts and acorns in the higher altitudes. Structures varied with the seasons, summer shelter consisted of a windbreak, trees, or a cave fronted with rocks. Winter dwellings had slightly sunken floors with dome-shaped structures made of brush thatch covered with grass and earth (Luomala 1978). In 1775, the seminomadic life was changed by the mission influence. Through successive Spanish, Mexican, and Anglo-American control, the Diequeño were forced to live a sedentary lifestyle, to adapt to agriculture, and to accept Christianity (Luomala 1978).

E.2.5 Kamia

The Kamia also identified with the Diegueño groups that occupied nearly the entire southern portion of the present state of California and portions of Baja California. Kamia inhabited the back channels of the Colorado River in the Imperial Valley and some areas on the main river (Luomala 1978). According to Kroeber (1925), they also inhabited portions of the mountains from the Salton Sea to San Diego. Groups living in the Imperial Valley depended on agricultural products, and others living in the mountain areas hunted small game and foraged for wild plants (Luomala 1978). Cremation was practiced, and the ashes were placed in a pottery jar and buried or hidden in a cluster of rocks. Christianity and the establishment of the missions created hostility among the Kamia for many years. However, as their influence persisted the priests became successful in their efforts. It is estimated the Diegueño (including the Kamia) reached a population of 3,000 during the Mission Period (1769 to 1821). By the 1920s, it was between 700 and 800 (Kroeber 1925).

E.2.6 Mohave

The Mohave was the northernmost and largest of the Yuman-speaking tribes along the lower Colorado River. The Mohave had little political organization and no true villages but lived in settlements or rural neighborhoods scattered throughout the valleys. Most of the year, open-sided shades (ramadas) provided shelter, while more substantial sand-covered houses were used in the winter. The Mohave primarily depended on farming in the lowlands along the river for subsistence, supplementing their diet with fishing and gathering wild plants. The principal crop was maize (corn). In times of drought, the Mohave relied more heavily on hunting, fishing, and gathering. At death, the body was cremated with personal possessions (Stewart 1983).

The first Spanish explorer reached the Mohave Valley in 1776 and estimated the Mohave population at 3,000. Apprehensive of the increasing numbers of settlers entering their territory, the Mohave attacked a wagon train in 1858. As a result, Fort Mohave was established, and soon the Mohave were defeated. Today, many of the Mohave people live on the Colorado River Reservation, with income from irrigated farms and leases of reservation land to nontribal residents (Stewart 1983).

E.2.7 Quechan

The Quechan territory was situated between the confluence of the Gila and Colorado rivers to the north and south and is divided between the present day states of California and Arizona. Plant gathering in addition to cultivation provided a balance to the Quechan diet. Planted fields produced maize, tepary (a type of bean), melons, watermelons, black-eyed beans, pumpkins, and muskmelons. Winter wheat was harvested prior to the spring floods. Hunting game was minimal due to the harsh desert terrain (Bee 1983). The Spanish, Mexicans, and Anglos found the confluence of the Colorado and Gila rivers of great importance for early migration. Shortly after 1776, the Spanish established two major settlements near the rivers. A period of unrest pursued as the settlers turned to the Quechan fields for food and Spanish authority persisted over the native people. Quechan resistance continued until the US Army built a small garrison in 1852. In 1884, a reservation was established for the Quechan on the west side of the Colorado River (Bee 1983).

E.2.8 Serrano

The Serrano occupied an area in the San Bernardino Mountains extending west to the Cajon Pass, north to Victorville, east as far as Twentynine Palms, and south to the Yucaipa Valley. The Serrano were mainly hunters and gatherers, and they occasionally fished. Hunted game included mountain sheep, deer, antelope, rabbits, small rodents, and various birds, particularly quail. Vegetal staples consisted of acorn, piñon nuts, bulbs and tubers, shoots and roots, berries, mesquite, barrel cacti, and Joshua tree. Settlement locations were determined by water availability, and most Serranos lived in small villages near water sources. Houses and ramadas were round and constructed of poles covered with bark and tule mats. The Serrano practiced cremation up until Spanish contact. By 1834, most of the Serrano were relocated to Spanish missions and today live either on the Morongo or San Manuel reservations (Bean and Smith 1978b). In 1975, descendants of the Serrano numbered approximately 100.

E.2.9 Southern Paiute (Chemehuevi)

The Chemehuevi are one of 16 identified Southern Paiute groups. The main territory occupied by the Southern Paiute-Chemehuevi group was west of the Colorado River, extending approximately from present-day Blythe to just north of Needles and into California halfway to Twentynine Palms (Kelly and Fowler 1986; Earle 1997). Large game was hunted, but small game was the chief source of protein. Plant foods included piñon nuts, roots, agave, seeds, and berries. Some horticulture was being practiced at the time of Spanish contact in the 1770s (Earle 1997). Settlement was mobile and scattered, with recurrent residence in specific locations. Structures varied according to the season. During the winter, the Chemehuevi lived in earth-covered dwellings or caves (Kelly and Fowler 1986).

As early as the end of the 18th century, some Southern Paiute-Chemehuevi were being either enslaved or baptized in the Spanish settlements. In response, some Chemehuevi raided travelers along the Old Spanish Trail from the 1850s to the early 1870s. During that time, efforts were made to settle the Chemehuevi on the Colorado River

Reservation, but many did not agree to move there until the 20th century. In 1980, the Southern Paiute-Chemehuevi numbered approximately 124 (Kelly and Fowler 1986).

E.2.10 Baja California Groups

In addition to the above-mentioned tribes, the Paipai, Kiliwa, and Ñakipa spoke languages similar to the California groups and may have seasonally frequented areas of the Salton Basin. While primarily residing in Mexico, these groups shared a pan-Yuman commonality of language, technology, and ceremonial practices (Massey 1992). Broken into patrilineal bands, these groups lived in semipermanent settlements or rancherias containing 50 to 200 people. Subsistence was based on hunting, gathering, and fishing, with seasonal migrations to food sources (Massey 1992). Following Spanish settlement of the region, populations were drastically diminished due to disease. The Ñakipa group eventually became extinct. The Kiliwa and Paipai are the only two Baja California groups with traditional ties to the Salton Sea basin that remain as culturally distinct entities.

E.3 POST-CONTACT HISTORY

The history of the Salton Sea region since European contact can be divided into periods of exploration, transportation, irrigation and creation of the Salton Sea, mining, modern military, and recreation. A summary of these themes is provided below.

E.3.1 Exploration

In 1769, the Spanish began to establish a series of missions in Alta California that stretched from San Diego to Sonoma. Transporting supplies, soldiers, and colonists by sea from Mexico to the new outposts was expensive, creating the need for a route across the Colorado Desert (Pourade 1971; Bannon 1974). In 1771, Father Francisco Garcés reached the southern end of the Imperial Valley and became the first European to see the Salton Sink region. In 1774, Captain Juan Bautista de Anza, accompanied by Garcés, reached San Gabriel Mission near Los Angeles from Arizona, having accomplished the first European crossing of the Colorado Desert and the Salton Sink (Hoyt 1948; Dowd 1960; Pourade 1971; Bannon 1974).

In November 1825 a Mexican Army expedition traveled through San Gorgonio Pass and along the eastern side of the Salton Sink, turning east and reaching the Colorado River near present-day Blythe. Because they reported that the route was not practical, this route was little used for the remainder of the Mexican period, which ended in 1848 (Hoyt 1948; Johnston 1977; Nordland 1977). In 1826, the southerly Yuma to San Diego route was named the official road from Sonora to Alta California. This route was used by US Lieutenant-Colonel W. H. Emory, who passed through the southern portion of the Imperial Valley and Salton Sink in 1846 and again the following year when he accompanied General Kearny's US Army expedition through the area. In 1848, the Mormon Battalion followed Kearny's route, establishing a wagon road (Cory 1915; Dowd 1960; Fitch 1961; Duke 1974; Morton 1977).

E.3.2 Transportation

In 1853, the US government funded an expedition to survey a transcontinental railroad route. This group passed along what would become the eastern shore of the Salton Sea. The same year, another expedition built a wagon road through San Gorgonio Pass and across the Coachella Valley (Cory 1915; Hoyt 1948; Dowd 1960).

In 1862, when gold was discovered near the Colorado River in Arizona, a group of Los Angeles businessmen hired William D. Bradshaw to find a direct route east from the San Gorgonio Pass. Bradshaw's route left the old wagon road at Dos Palmas oasis, east of the present northeastern shore of the Salton Sea, and continued along Indian trails to the Colorado River just northeast of present-day Blythe. Cattlemen and merchants soon began using the Bradshaw Trail to supply the gold miners. Before the railroad was completed to Yuma in 1877, stage lines linked with the tracks at Dos Palmas Station and continued along the trail into Arizona (Fitch 1961; De Stanley 1966; Pepper 1973; Duke 1974; Johnston 1977; Nordland 1977; Ross 1992).

By 1876, the first Southern Pacific train had reached Indian Wells (Indio). In 1877, the tracks finally extended to Yuma, Arizona. A southern branch line from Niland to Calexico was built in 1904. That same year, a rail line was constructed to connect El Centro and Holtville. Lines from El Centro to Seely, Calipatria to Sandia, and Sandia to Holtville were completed between 1910 and 1930. A connection between El Centro and San Diego was completed in 1919 (Hoyt 1948; Fitch 1961; Lamb 1992).

E.3.3 Irrigation and the Creation of the Salton Sea

In 1891, the Colorado River Irrigation Company was formed to provide irrigation for agriculture in the Imperial Valley, but it soon ran into financial difficulties. Engineer Charles R. Rockwood formed a new company in 1896 to pursue the goal of providing irrigation for the Imperial Valley (Cory 1915; Kennan 1917; Fitch 1961; Nordland 1977).

Work on the Imperial Canal was begun in 1900, with Pilot Knob, about one mile north of the international boundary, chosen as the diversion point on the Colorado River. New canal segments were constructed, and portions of the Alamo River were used. The Central Main Canal was built northward from Calexico, and in 1902 irrigation of the Imperial Valley began. Agricultural development of the sink exceeded expectations. The towns of Mexicali, Calexico, Heber, Imperial, and Brawley were founded. By 1905, more than 120,000 acres were under cultivation (Cory 1915; Kennan 1917; Dowd 1960; Fitch 1961).

In 1903, the US government tried to stop diversion of Colorado River water for use in the Imperial Valley. For that reason, and to bypass increased silting at the original intake, the California Development Company built a canal head in Mexico. A series of floods in 1905 destroyed a temporary dam and eroded the new canal intake. Water then rushed into the Imperial Canal-Alamo River system, allowing the entire discharge of the Colorado River to pour into the Salton Sink, creating the Salton Sea (Cory 1915; Kennan 1917; Fitch 1961; Duke 1974; Woerner 1989).

After the floods had subsided, work on a diversion dam began. This first attempt to control the river failed. A second attempt to control the flow consisted of a permanent concrete flow gate. In 1906, a flood choked the gate with silt and debris, and again water rushed back into the Imperial Canal toward the Salton Sea. Immense quantities of rock were then unloaded along two large wooden trestles built in a curve across the river. On February 10, 1907, the break was closed, and the flow into the Salton Sink ended after a two-year struggle (Cory 1915; Kennan 1917; Fitch 1961; Duke 1974; Woerner 1989).

Unstable political relations with Mexico led to a plan in 1919 to construct a canal on the US side of the border. The Coachella Valley County Water District, formed in 1918, cooperated with the Imperial Irrigation District, which had been established in 1911, to plan and promote the new canal. In December 1928 Congress passed the Boulder Canyon Project Act, which initiated the construction of Hoover and Imperial dams and the All American canal system. By February 1942 the canal was supplying the Imperial Valley with water. A branch was completed in 1948 to service the Coachella Valley (Dowd 1960; Fitch 1961; Nordland 1977, 1978). Today, the IID provides water for 6,471 square miles in the Imperial Valley (Imperial Irrigation District 1998). The Coachella Valley Water District services approximately 1,000 square miles (Coachella Valley Water District 1999).

E.3.4 Mining

Salt has been an important resource in this region, having accumulated for centuries at the bottom of the Salton Sink. The first European-American exploitation of the salt deposits was in 1884, when the New Liverpool Salt Company built a plant at the north end of the sink. Soon, a second salt enterprise began operations nearby, and a rivalry continued until 1905, when both were inundated by the rising Salton Sea. A number of salt mines and evaporation ponds operated on the shores of the Salton Sea and Mullet Island until the 1940s (Fitch 1961; De Stanley 1966).

Calcite was mined from the mountains west of the Salton Sea and was used in the manufacture of optical gun sites during World War II. Wells drilled at the southeastern end of the Salton Sea once tapped into carbon dioxide deposits that were used to produce dry ice. In the early 1950s, sea level rose and submerged the well heads, ending production. In the early 1920s, the Imperial Valley Gypsum and Oil Corporation began gypsum quarrying for cement production in the Fish Mountains and built a mill that is still operational 16 miles west of El Centro at Plaster City (Fitch 1961; Lamb 1992).

E.3.5 Modern Military

In 1942, the California-Arizona Maneuver Area and the Desert Training Center were established by General George S. Patton. The maneuver area stretched from western Arizona northwest to the eastern Mojave Desert of California, crossing the study area several miles east of the Salton Sea. Camp Young, headquarters of the Desert Training Center, was located near Chriaco Summit, approximately 17 miles northeast of the Salton Sea (Ross 1992).

In 1942, the US Navy constructed a sea plane base at the southwestern end of the Salton Sea. After World War II, this area was named the Salton Sea Test Base, and its focus turned to the testing of new weapons technology, including test drops of inert nuclear weapons (Apple et al. 1997). The base in now closed. The US Navy also maintains the extensive Chocolate Mountain Naval Aerial Gunnery Range, occupying most of the mountain range east of the Salton Sink. The Navy also reserves several smaller areas to the east and west of Brawley and El Centro for such activities as a parachute drop zone.

E.3.6 Recreation

Recreational activities precipitated several major developments around the Salton Sea shore. The CDFG was stocking the Sea with numerous game species by the 1920s. Several federal and state wildlife refuges were established in 1952 and were opened to hunting for ducks and geese. Other recreational activities that take place in the Salton Sea area include swimming, boat racing, water skiing, birding, hiking, and mineral and fossil collecting. Several movies have been filmed at the Sea and in the nearby desert (Fitch 1961; De Stanley 1966).

In 1958, communities such as Salton City, Salton Beach Estates, Desert Shores, and North Shore Beach Estates were all established. These settlements offered marinas, restaurants, motels and hotels, golfing, and boat-launching facilities for visitors, as well as planned residential communities, schools, and yacht clubs for residents (De Stanley 1966). For various reasons, including distance from southern California population centers, increasing salinity, pollution of the Salton Sea, and fluctuating Sea surface levels, these resorts have not achieved the popularity their developers originally envisioned.

TC 10138-18

DRAFT
FIGURES TO ACCOMPANY

SALTON SEA RESTORATION PROJECT ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT

January 2000

Prepared for:

Salton Sea Authority
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Bureau of Reclamation
P.O. Box 61470
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Prepared by:

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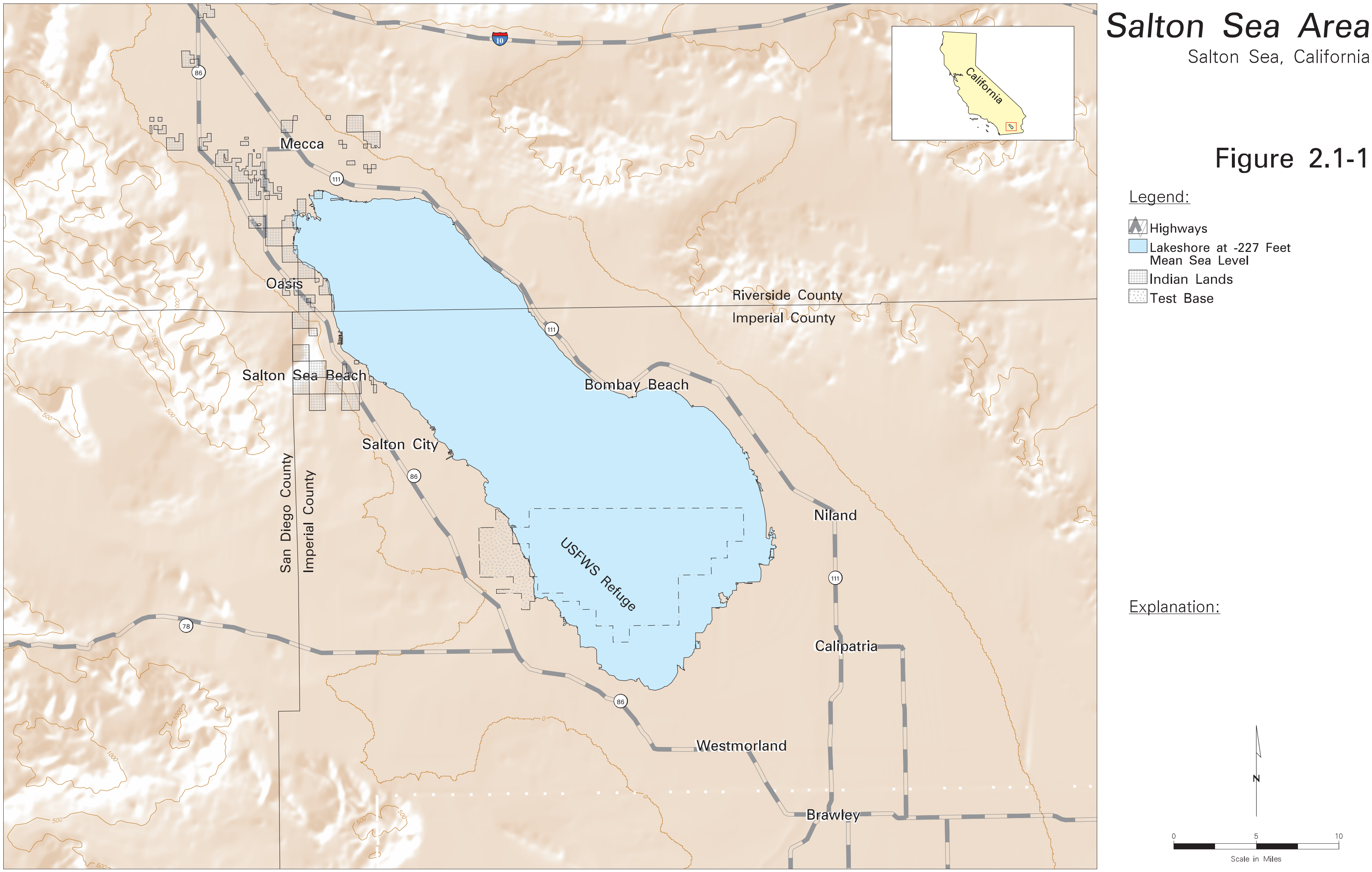


Salton Sea Area

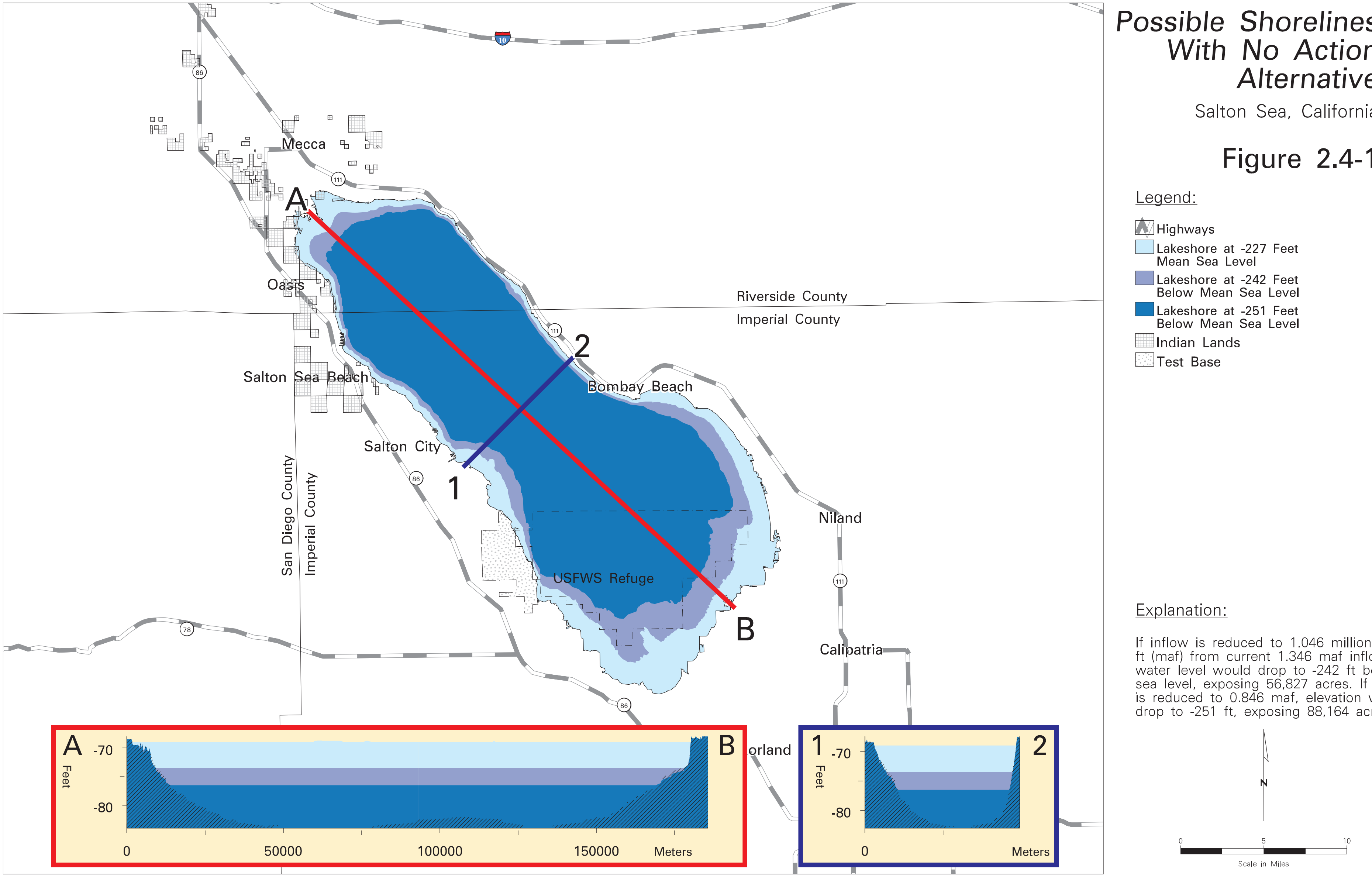
Salton Sea, California

Figure 2.1-1

Possible Shorelines With No Action Alternative

Salton Sea, California

Figure 2.4-1



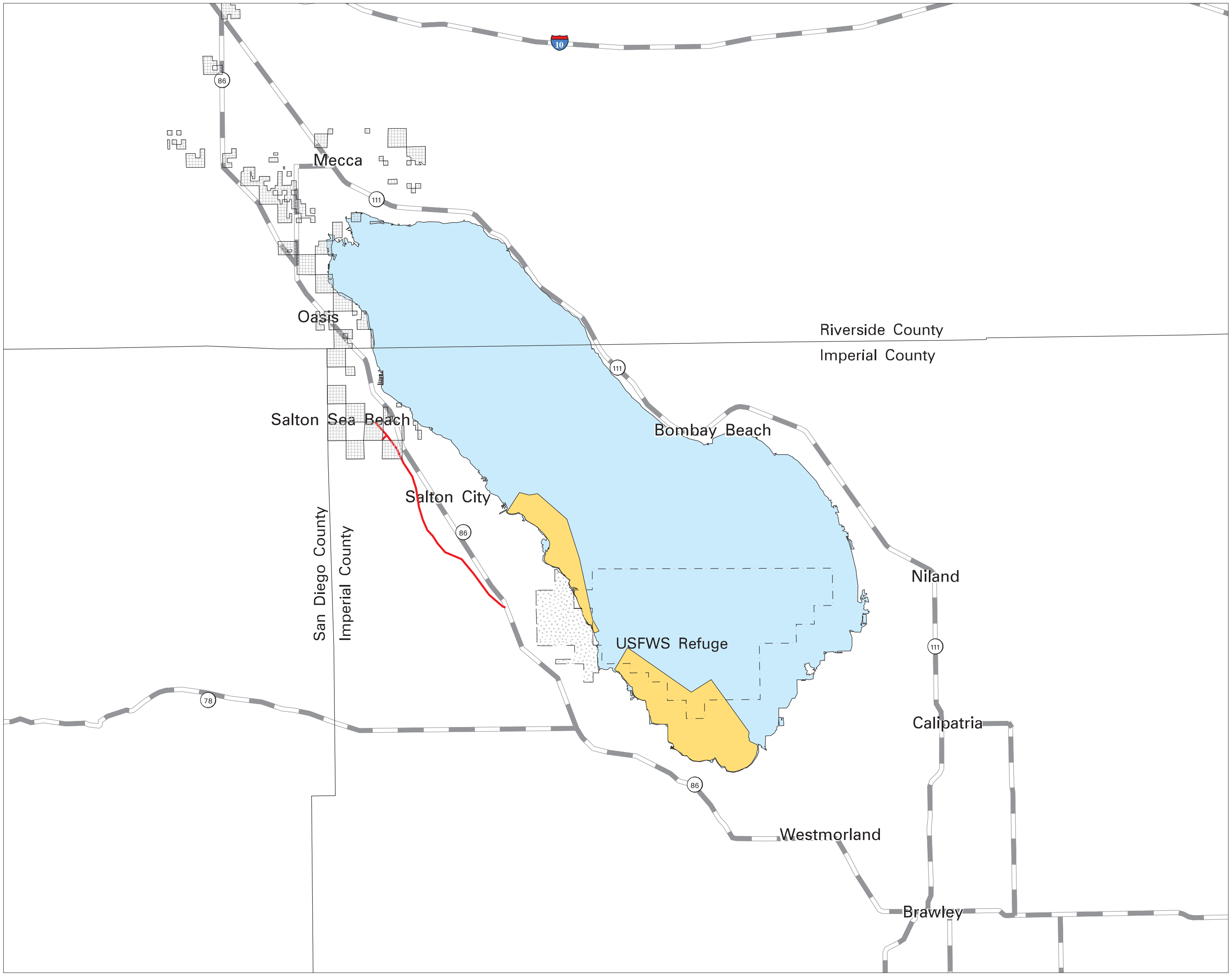
Explanation:

If inflow is reduced to 1.046 million acre ft (maf) from current 1.346 maf inflow, water level would drop to -242 ft below sea level, exposing 56,827 acres. If inflow is reduced to 0.846 maf, elevation would drop to -251 ft, exposing 88,164 acres.

Evaporation Ponds Used in Alternatives 1 and 4

Salton Sea, California

Figure 2.5-4

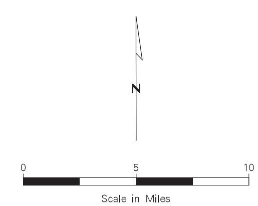


Legend:

- Highways
- Lakeshore at -227 Feet Mean Sea Level
- Proposed Sites for Evaporation Ponds
- Haul Road
- Indian Lands
- Test Base

Explanation:

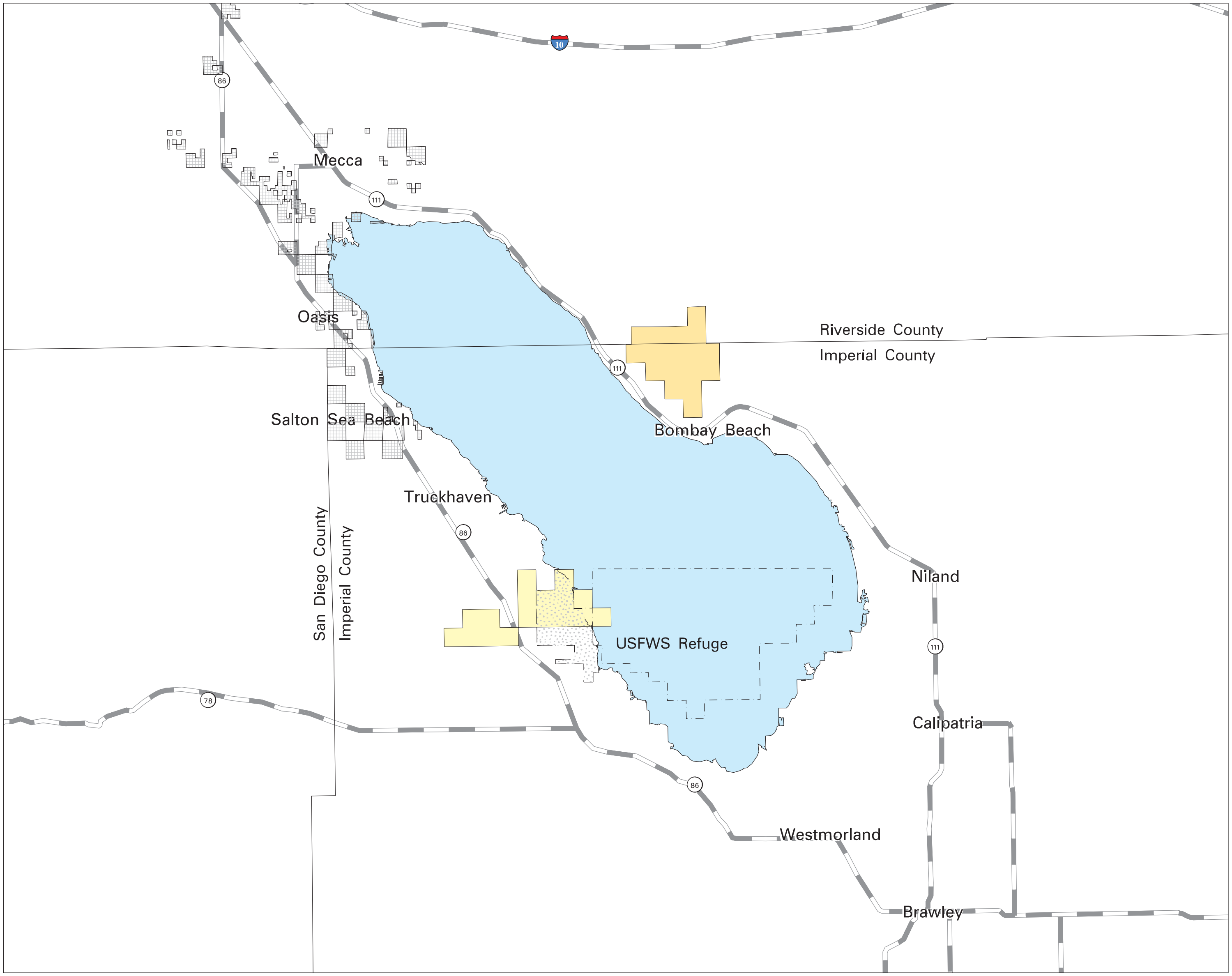
Ponds would be constructed adjacent to the Salton Sea Test Base Site.
Source: Bureau of Reclamation



EES Facilities

Salton Sea, California

Figure 2.5-8



Legend:

- Highways
- Lakeshore at -227 Feet Below Sea Level
- EES Location Used for Alternatives 3 and 4
- EES Locations Used for Alternative 2 and 5
- Indian Lands
- Test Base

Explanation:

Proposed locations for EES sites near the Salton Sea Test Base and Bombay Beach. Map based on Bureau of Land Management proposed engineering alternatives for Salton Sea restoration efforts.

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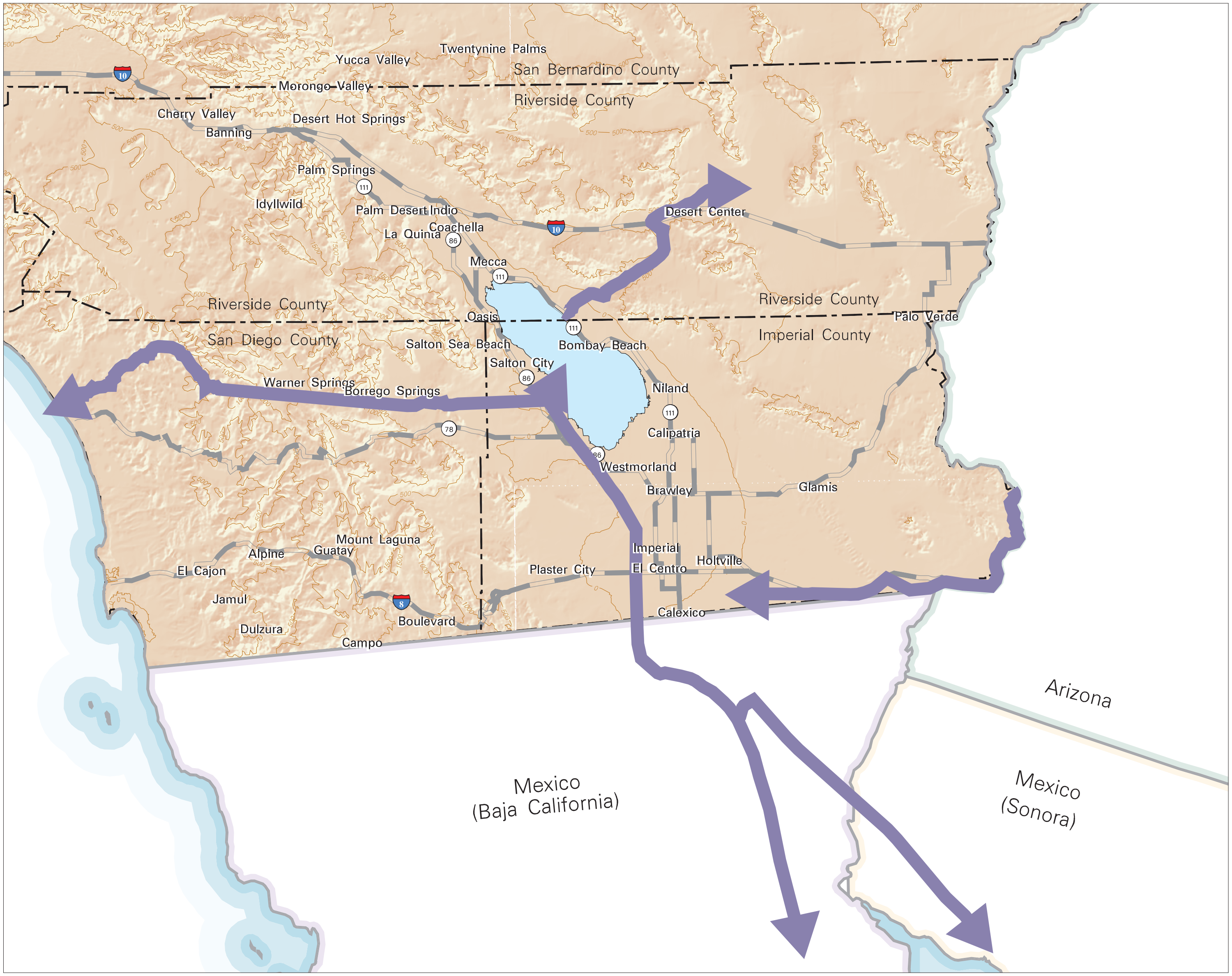
Scale in Miles



Pipeline Locations

Salton Sea, California

Figure 2.6-1

Legend:

- Lakeshore at -227 Feet Mean Sea Level
- Highways
- Proposed Pipeline Locations

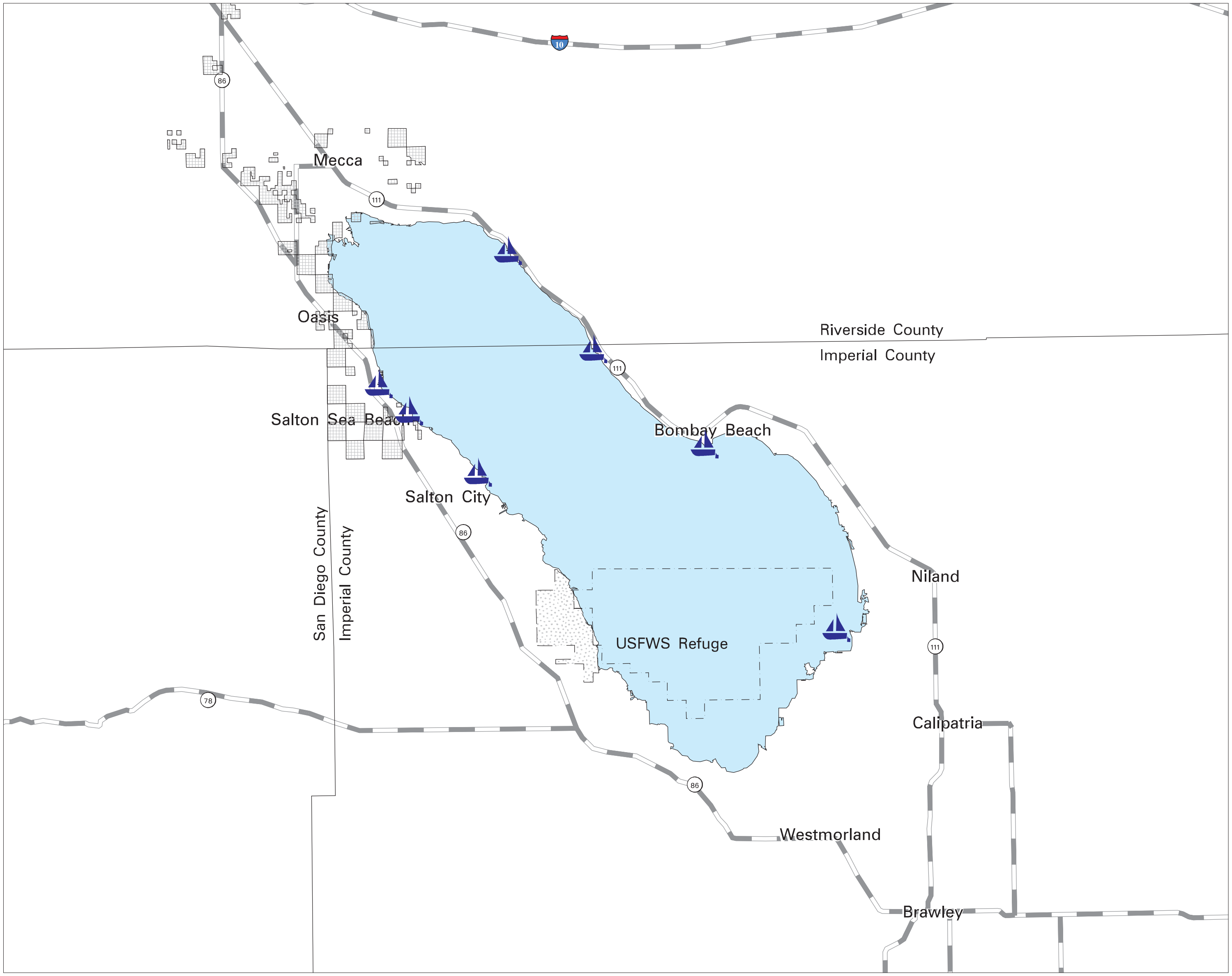
Explanation:

Proposed pipeline alternatives provided by Bureau of Reclamation.

Existing Public Boat Docks

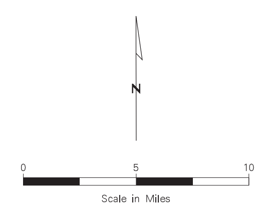
Salton Sea, California

Figure 2.6-2



Legend:

- Highways
- Lakeshore at -227 Feet Mean Sea Level
- Boat Launches
- Indian Lands
- Test Base



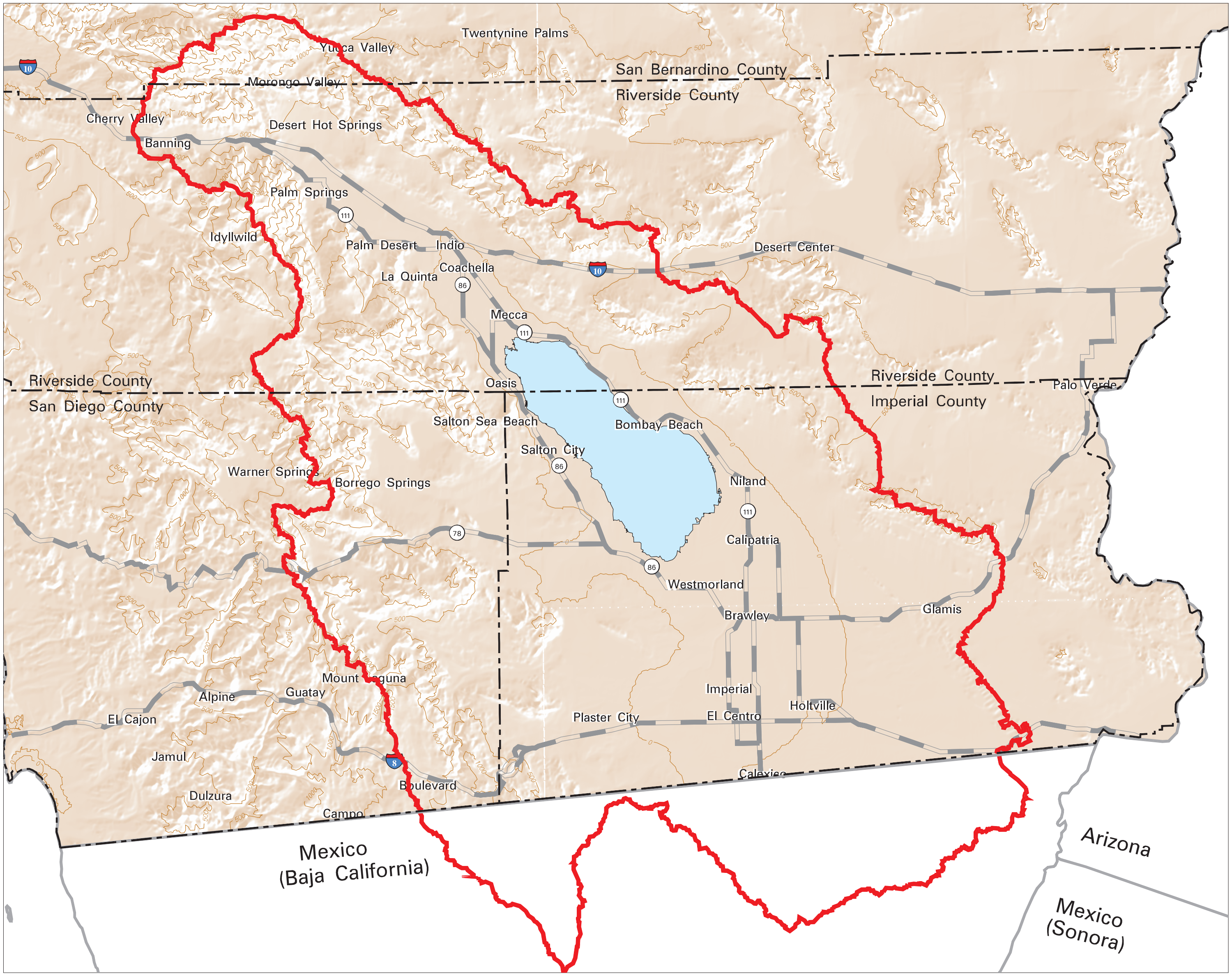
Explanation:

Boat launch locations along the Salton Sea shoreline. Map based on data from the Stephen P. Teale Data Center.

Watershed Boundary

Salton Sea, California

Figure 3.1-1



Legend:

- Lakeshore at -227 Feet Mean Sea Level
- Highways
- Watershed Boundary

Explanation:

This map displays the Salton Sea watershed study area generated from drainage models developed from a 90-meter DEM. Source: Salton Sea Database Program.

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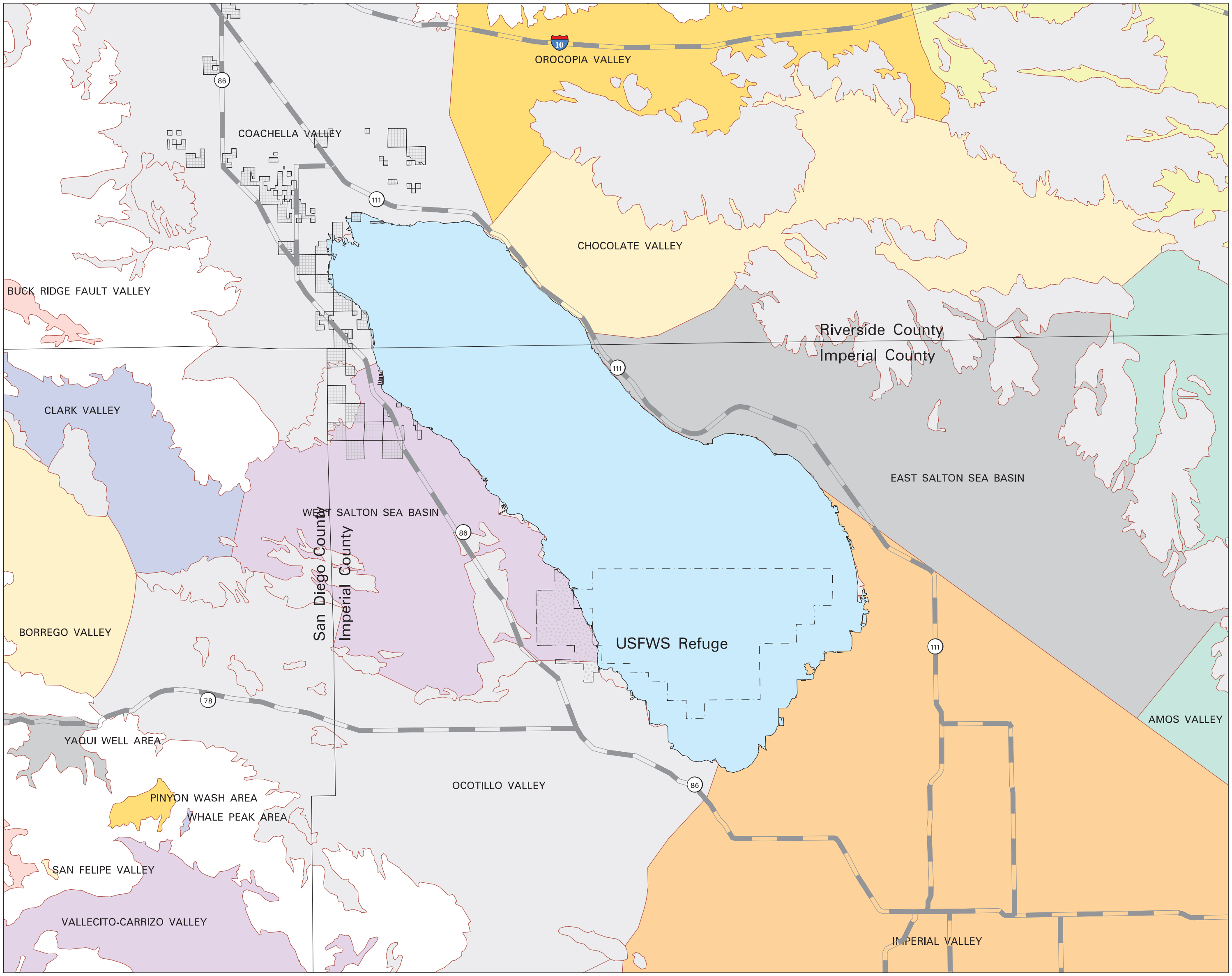
0 10 20

Scale in Miles



Ground Water Basins

Salton Sea, California

Figure 3.2-1

Legend:

- Lakeshore at -227 Feet Mean Sea Level
- Indian Lands
- Test Base
- Highways

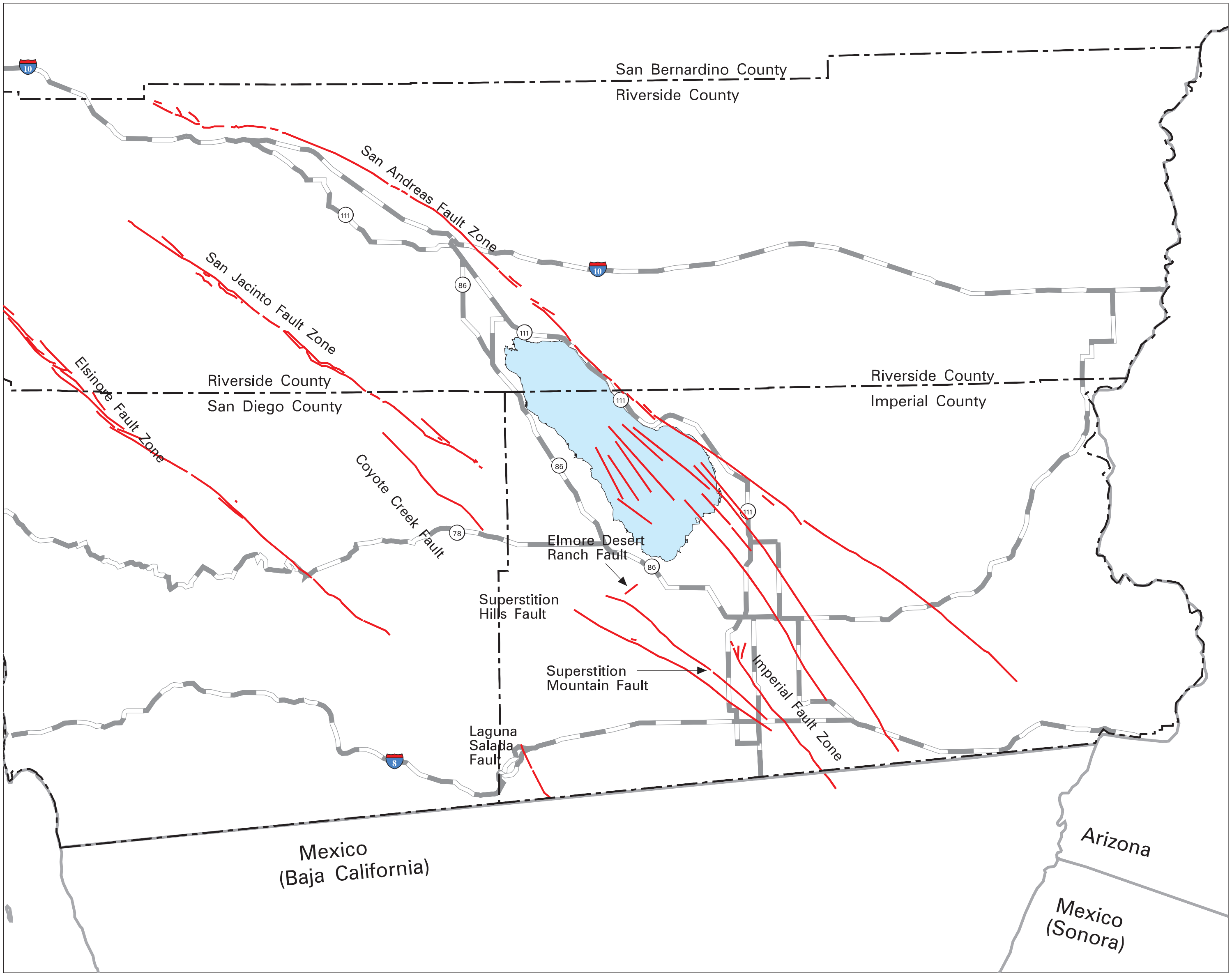
Explanation:

Groundwater basin data is provided by the Teale Data Center. Groundwater basins are determined by California Department of Water Resources classifications.

Fault Map

Salton Sea, California

Figure 3.3-1



Legend:

- Lakeshore at -227 Feet Mean Sea Level
- Highways
- Faults

Explanation:

This data provides a regional overview of fault zones located in the Salton Sea region. Map based on United States Geological Survey data.

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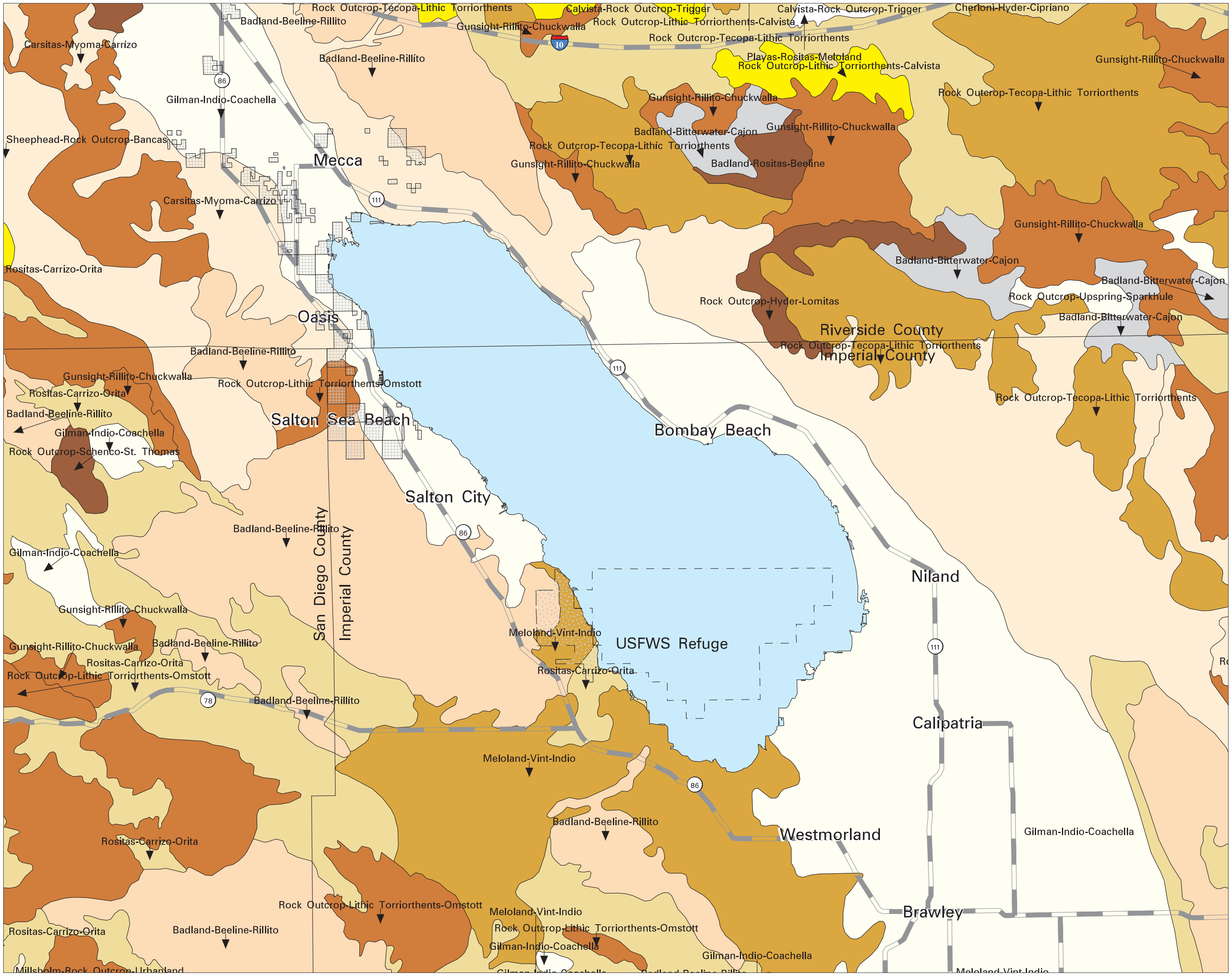
0 10 20

Scale in Miles

Soil Associations

Salton Sea, California

Figure 3.3-2

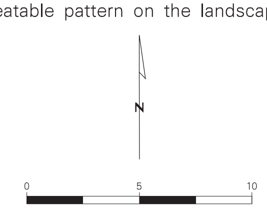


Legend:

- Highways
- Lakeshore at -227 Feet Mean Sea Level
- Indian Lands
- Test Base

Explanation:

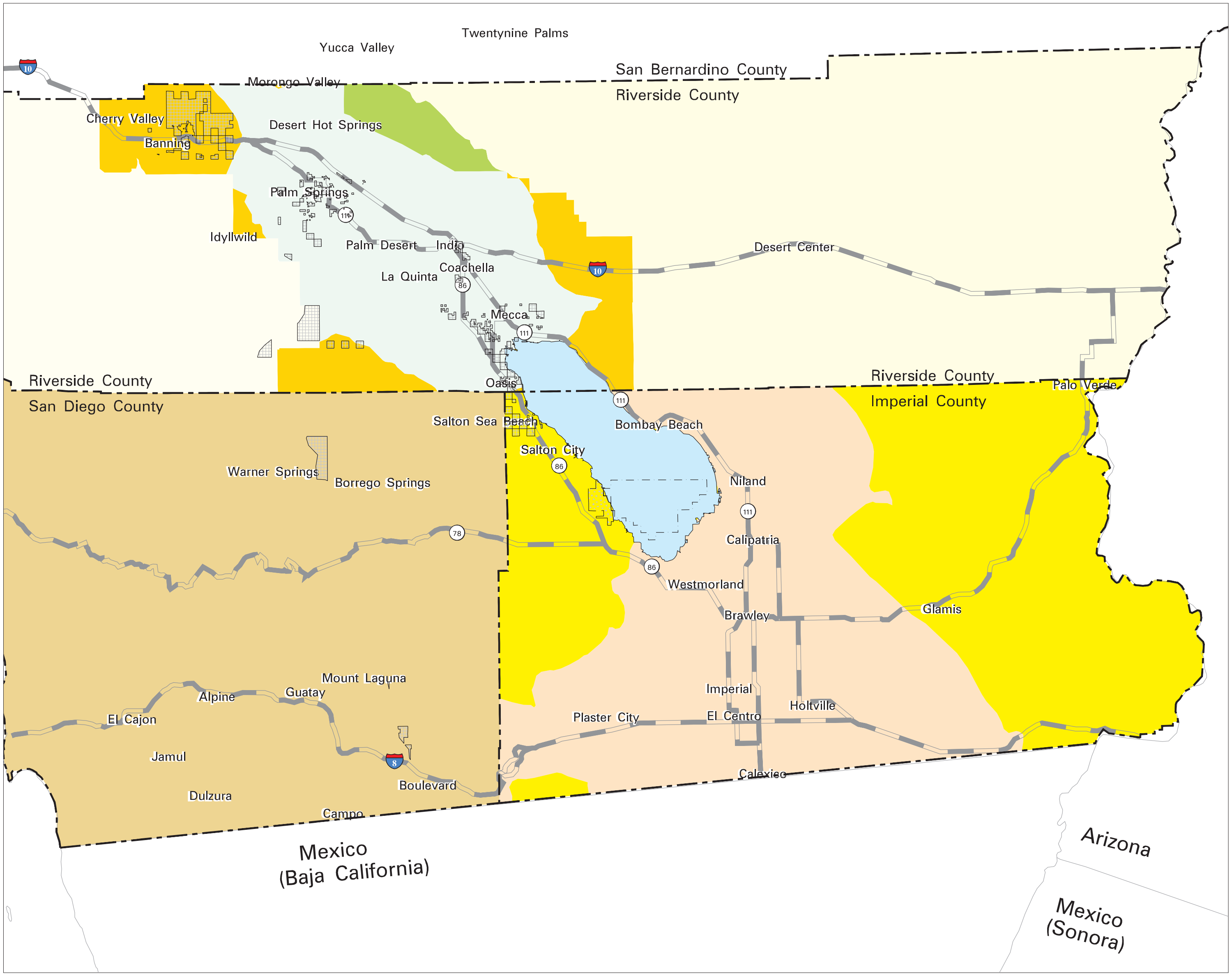
This map is a general soil association map developed by the National Cooperative Soil Survey. It consists of a broad based inventory of soils and nonsoil areas that occur in a repeatable pattern on the landscape.



Federal Air Quality Nonattainment Designations

Salton Sea, California

Figure 3.4-1

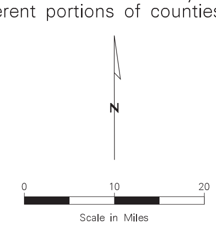


Legend:

- South Coast Air Basin, Riverside County. Extreme ozone nonattainment, serious CO nonattainment, NO2 nonattainment, & serious PM10 nonattainment.
- Air Quality Management Area, Riverside County. Severe ozone nonattainment.
- Air Quality Management Area & Coachella Valley Planning Area, Riverside County. Severe ozone nonattainment & serious PM10 nonattainment.
- Coachella Valley Planning Area, Riverside County. Serious PM10 nonattainment.
- Remainder of Riverside County. Attainment for all Federal standards.
- Imperial Valley Planning Area, Imperial County. Moderate PM10 nonattainment.
- Imperial County. Transitional ozone nonattainment.
- San Diego County. Serious ozone nonattainment.
- Lakeshore at -227 Feet Mean Sea Level
- Highways

Explanation:

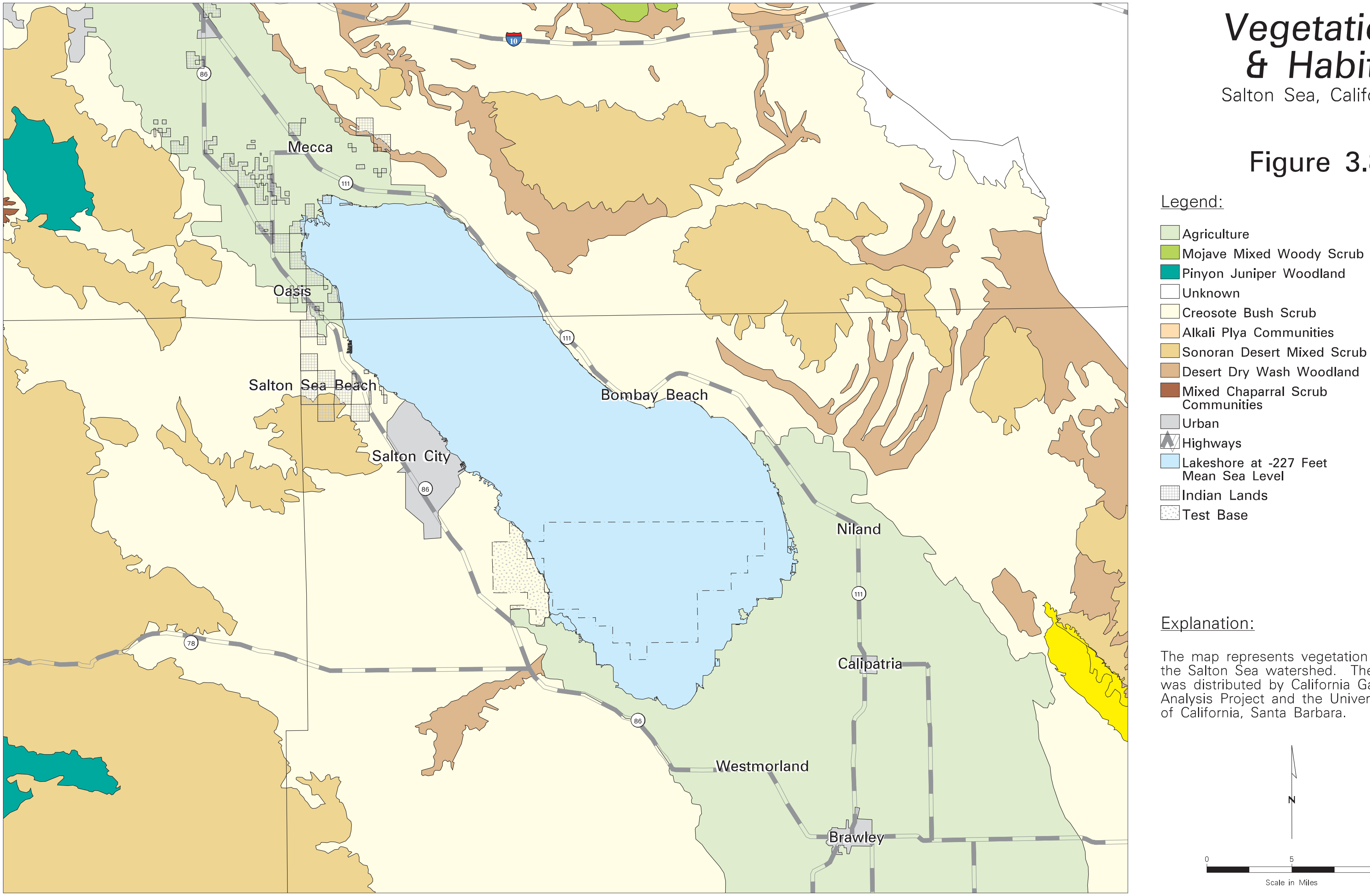
Federal ozone & PM10 nonattainment designations affect most of the Salton Sea Basin. Nonattainment designations are made separately for ozone and PM10 which have different severity designations in different portions of counties.



Vegetation & Habitat

Salton Sea, California

Figure 3.8-1



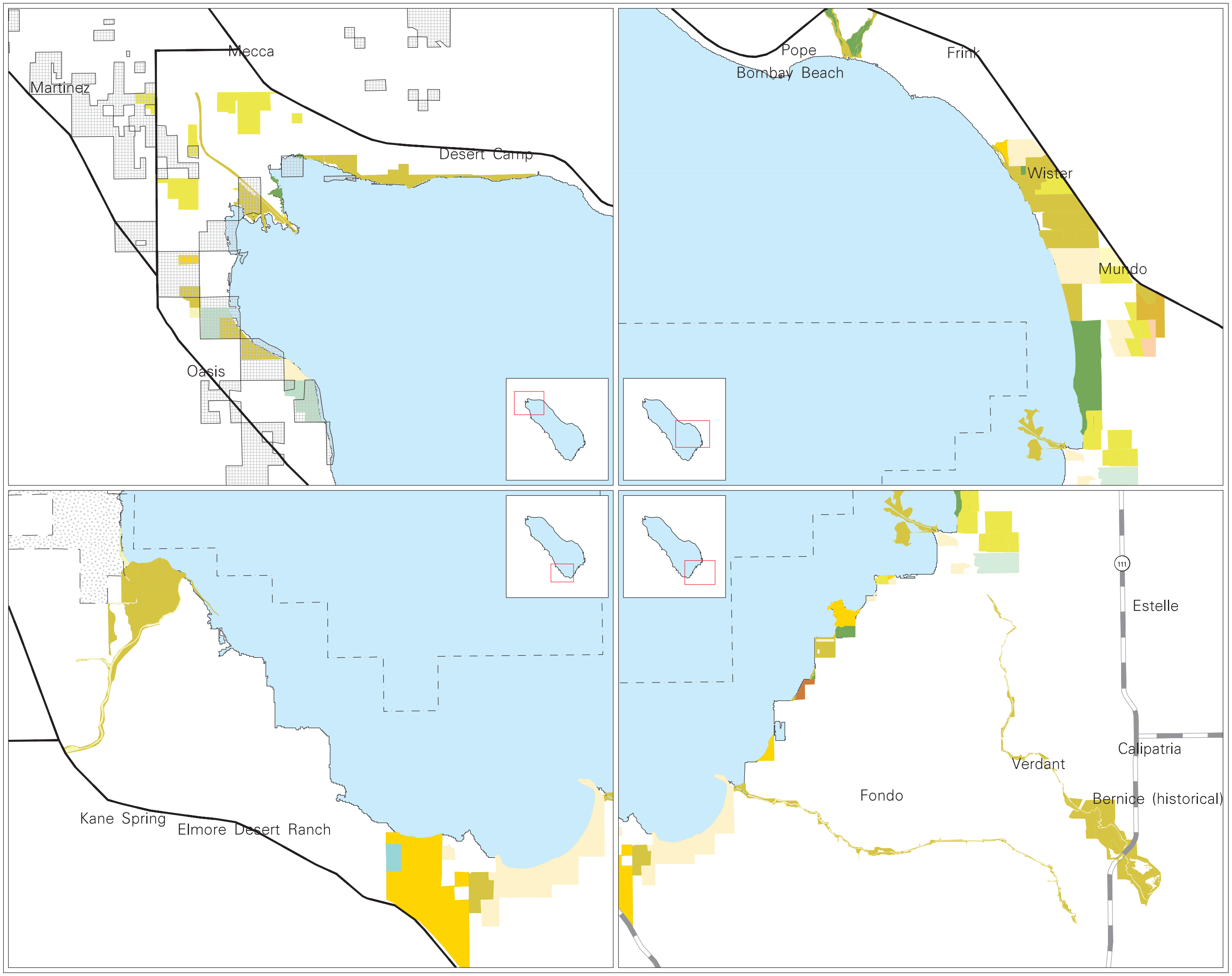
Explanation:

The map represents vegetation in the Salton Sea watershed. The data was distributed by California Gap Analysis Project and the University of California, Santa Barbara.

Wetlands Vegetation

Salton Sea, California

Figure 3.8-2



Legend:

- Lakeshore at -227 Feet Mean Sea Level
- Iodine Bush
- Safflower
- Mixed Halophytic Species
- Barley
- Common Reed
- Adjacent Wetland
- Mesquite
- Bulrush
- Sea-blite
- Tamarisk
- Broad-leaf Cattail
- Managed Wetland
- Mudflats
- Indian Lands
- Test Base
- Highways

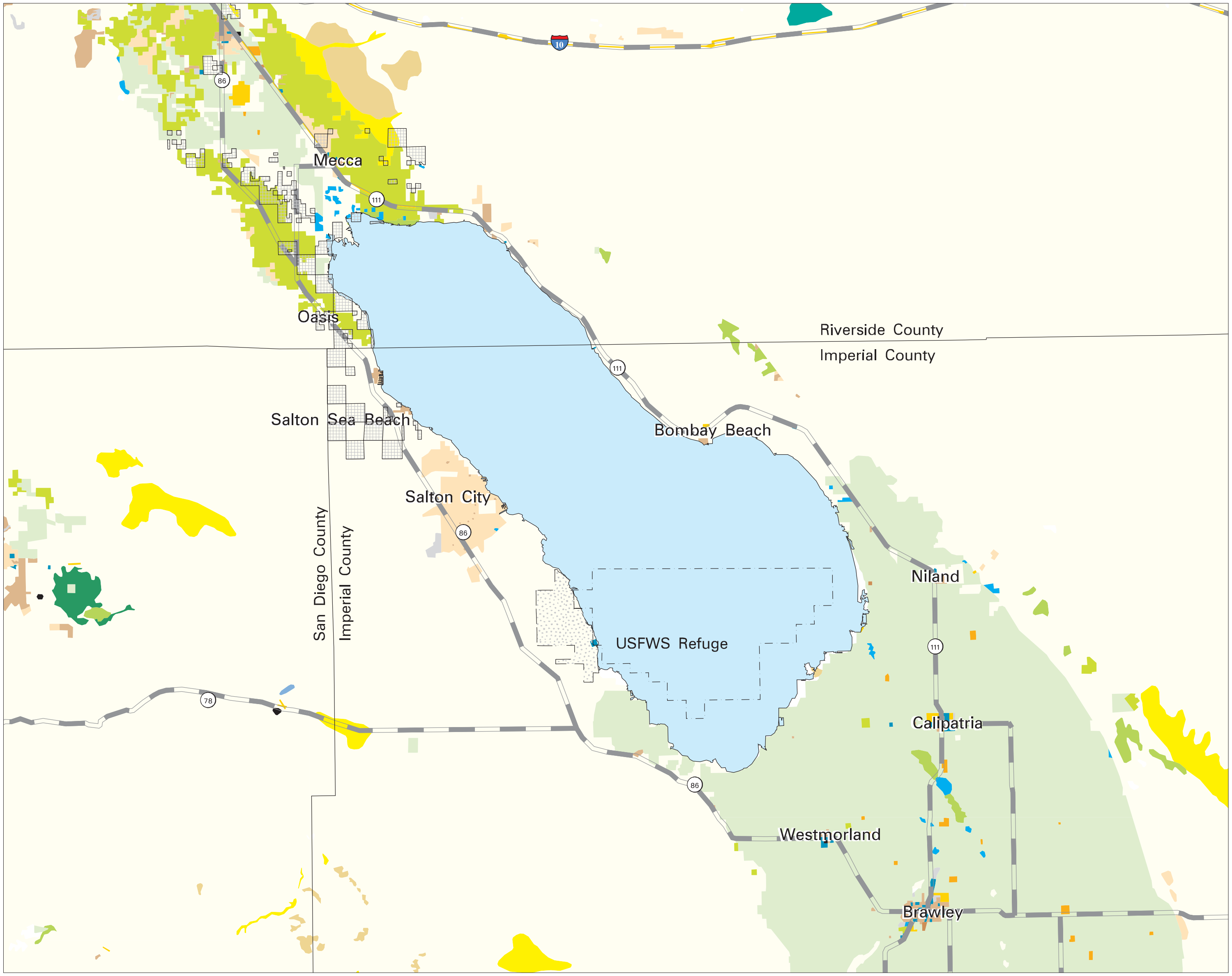
Explanation:

A combined vegetation and wetlands coverage has been produced utilizing digital orthophotograph quarter-quadrangles.

Land Use

Salton Sea, California

Figure 3.10-1



Legend:

- Bare Exposed Rock
- Commercial and Services
- Confined Feeding Operations
- Nonforested Wetlands
- Dry Salt Flats
- Industrial
- Mixed Forest Land
- Mixed Rangeland
- Mixed Urban or Built Up Land
- Other Urban or Built Up Land
- Reservoirs
- Residential
- Sandy Areas (not beaches)
- Shrub and Brush Rangeland
- Transitional Areas
- Transportation, Communication, or Utilities
- Cropland and Pasture
- Orchards, Groves, Vineyards, or Nuseries
- Highways
- Lakeshore at -227 Feet Mean Sea Level
- Indian Lands
- Test Base

Explanation:

Land use areas are determined by Anderson Land Classifications. Data was provided by the United States Geological Survey.

N

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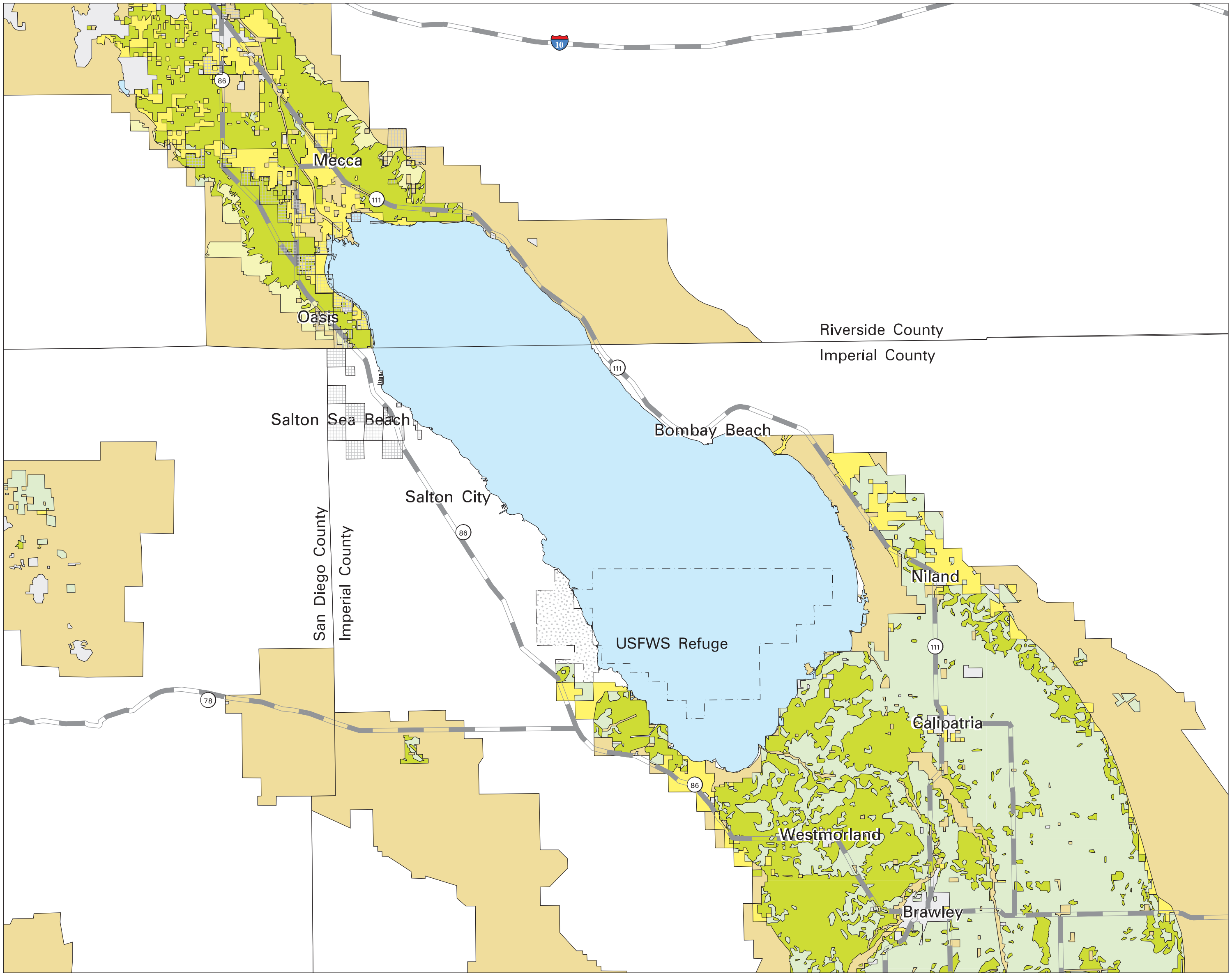
Scale in Miles



Farmland

Salton Sea, California

Figure 3.11-1

Legend:

- Area Not Mapped
- Farmland of Local Importance
- Farmland of Statewide Importance
- Prime Farmland
- Unique farmland
- Urban & Built Up Land
- Water
- Other Land
- Highways
- Lakeshore at -227 Feet Mean Sea Level
- Indian Lands
- Test Base

Explanation:

Farmland data was created by the California Division of the Land Resource Protection Agency. Additional modifications, Tetra Tech 1999.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)/ENVIRONMENTAL IMPACT REPORT (EIR)
SALTON SEA RESTORATION PROJECT

State Clearinghouse # ____________________
Riverside and Imperial Counties, California

Co-Lead Agencies:
Lead Agency for the EIS: US Bureau of Reclamation
Lead Agency for the EIR: Salton Sea Authority

Cooperating Agencies:

US Environmental Protection Agency	US Army Corps of Engineers
US Geological Survey	US Fish and Wildlife Service
Torres Martinez Band of Cahuilla Indians	US Bureau of Land Management
US Bureau of Indian Affairs	Coachella Valley Water District
Imperial Irrigation District	California Department of Fish and Game
Riverside County	Imperial County
California Regional Water Quality Control Board	

ABSTRACT

The Bureau of Reclamation and the Salton Sea Authority are proposing to maintain and restore the ecological and socioeconomic values of the Salton Sea, an artificially maintained body of water in south central California. Alternatives include methods to control salinity, improve recreation facilities, manage the fish population, provide additional water, develop wetland habitat, and study the many outstanding questions that remain concerning the issues and appropriate management of the Salton Sea. Proposed actions are divided into two phases, with the first phase attempting to maintain and restore the Sea for up to 30 years. The second phase is discussed programmatically and will provide continued protection of values for up to 100 years. This draft EIS/EIR will be forwarded to Congress along with a Strategic Science Plan and a Reclamation Report on the engineering viability of the alternatives proposed.

This Draft EIS/EIR has been prepared in accordance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

Comments on this document must be submitted by April 21, 2000.

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January 2000